Rational Use of Rangelands and Fodder Crop Development in Africa
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African Union - Interafrican Bureau for Animal Resources

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**PREFACE**

Global recognition that desertification poses not only environmental but also economic and social challenges to human development, has led to concerted efforts to address the problem globally, with particular focus on drylands in Africa. The efforts culminated in the establishment of the United Nations Convention to Combat Desertification (UNCCD) in 1994. UNCCD is the sole legally binding international agreement linking environment and development issues to the land agenda. To address the enormity of desertification as a major constraint to sustainable economic development of semi-arid areas in Africa, the UNCCD was prompted to launch the Regional Action Programme (RAP) to combat desertification in Africa. At national level, the focal points for the RAP are the National Action Programmes (NAP). The UNCCD set out to accomplish its objective through six Thematic Programme Networks (TPNs):

i. TPN1 Integrated management of international river, lake and hydro-geological basins  
ii. TPN2 Promotion of agroforestry and soil conservation  
iii. TPN3 Rational use of rangelands and promotion of fodder crops development  
iv. TPN4 Ecological monitoring, natural resources mapping, remote sensing and early warning systems  
v. TPN5 Promotion of new and renewable energy sources and technologies  
vi. TPN6 Promotion of sustainable agricultural farming systems

The basis of networking was to facilitate the exchange and sharing of technologies, as well as provide the mechanism for harmonizing and coordinating policies, strategies and action programs for the rational use of rangelands and development of fodder crops at continental level. The Thematic Programme Network 3 (TPN 3) was launched in Maseru, Lesotho on 27-29 November 2001 with its Institutional Focal Point being the African Union-Interafrican Bureau for Animal Resources (AU-IBAR) and set out to accomplish the following tasks:

- To promote capacity-building in rational use of rangelands and fodder crops development activities that are better implemented at the regional level;  
- To strengthen exchange of information and appropriate techniques, technical know-how and relevant experience as it relates to rational use of rangelands and promotion of fodder crops development;  
- To co-ordinate and compile activities related to combating African Union - Interafrican Bureau for Animal Resources desertification from
various aspects, undertaken by different stakeholders, in order to prevent duplication and increase efficiency, thus benefiting countries of the regions with minimum expenditure;

- To assist the African country Parties as well as the relevant sub-regional and specialized institutions to carry out their obligations in implementing the Convention at regional level.

To combat desertification through promoting rational use of rangelands and fodder crop development in Africa, ten (10) programme areas were proposed during the launch of UNCCD TPN3. These areas include:

Support to sustainable pastoral livelihoods
1. Rationalization of rangeland use through positive changes in land tenure and land use policy
2. Intervention in conflict transformation and community peace building initiatives
3. Drought management, risk analysis and prediction
4. Analysis of livestock and environment interactions
5. Improving animal feed resources in African rangelands
6. Strengthening the pastoral economy through human resource capacity building
7. Promotion of rational use of rangelands through application of appropriate range management practices
8. Adaptive research on rangeland development and fodder crop development
9. Promotion of trade in livestock and livestock products.

In the context of the above programme areas, efforts of African countries in fighting land degradation in the ASALs since the inception of UNCCD TPN3 provide good lessons for the UNCCD TPN3 members and the wider fraternity dealing with desertification in Africa’s rangelands. Good practices from various pilot projects have been implemented by various players not necessarily under the auspices of UNCCD RAP, Sub Regional Action Programs and NAPs. Sharing out these lessons and good practices would be a critical step in promoting continent-wide efforts to fighting desertification and for the strengthening sustainable livelihoods of communities in the rangelands. This monograph, therefore, details some of the most widely proven and accepted sustainable natural resources management practices that respond to UNCCD’s overall goal of rational management and improvement of rangeland resources for sustaining human livelihoods and the environment.

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### ACRONYMS AND ABBREVIATIONS

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<thead>
<tr>
<th>Acronym</th>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ASALs</td>
<td>Arid and semi arid lands</td>
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<tr>
<td>AU-IBAR</td>
<td>African Union-Interafrican Bureau for Animal Resources</td>
<td></td>
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<tr>
<td>AWF</td>
<td>African Wildlife Foundation</td>
<td></td>
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<tr>
<td>CBD</td>
<td>Convention on Biological Diversity</td>
<td></td>
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<tr>
<td>CBNRM</td>
<td>Community based natural resource management</td>
<td></td>
</tr>
<tr>
<td>CBOs</td>
<td>Community-based organizations</td>
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<tr>
<td>COMESA</td>
<td>Common Market for Eastern and Southern Africa</td>
<td></td>
</tr>
<tr>
<td>DLWEIP</td>
<td>Dryland Livestock Wildlife Environment Interface Project</td>
<td></td>
</tr>
<tr>
<td>EAC</td>
<td>East African Community</td>
<td></td>
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<tr>
<td>ECOWAS</td>
<td>Economic Community of West African States</td>
<td></td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
<td></td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>ICARDA</td>
<td>International Centre for Agricultural Research in the Dry Areas</td>
<td></td>
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<tr>
<td>ICRAF</td>
<td>World Agroforestry Centre</td>
<td></td>
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<tr>
<td>IIED</td>
<td>International Institute for Environment and Development</td>
<td></td>
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<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
<td></td>
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<tr>
<td>IGAD</td>
<td>Intergovernmental Authority on Development</td>
<td></td>
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<tr>
<td>ITC</td>
<td>International Transhumance Certificate</td>
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</tr>
<tr>
<td>ITCZ</td>
<td>Inter-Tropical Convergence Zone</td>
<td></td>
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<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature</td>
<td></td>
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<tr>
<td>MDG</td>
<td>Millennium Development Goals</td>
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<tr>
<td>MW</td>
<td>Megawatts</td>
<td></td>
</tr>
<tr>
<td>NAP</td>
<td>National Action Programme</td>
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</tr>
<tr>
<td>NGOs</td>
<td>Non-governmental organizations</td>
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</tr>
<tr>
<td>Nile BDC</td>
<td>Nile Basin Development Challenge</td>
<td></td>
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<tr>
<td>NRM</td>
<td>Natural Resource Management</td>
<td></td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Co-operation and Development</td>
<td></td>
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<tr>
<td>PES</td>
<td>Payments for Environmental Services</td>
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<tr>
<td>PFS</td>
<td>Pastoral Field Schools</td>
<td></td>
</tr>
<tr>
<td>RAP</td>
<td>Regional Action Programme</td>
<td></td>
</tr>
<tr>
<td>SLM</td>
<td>Sustainable land management</td>
<td></td>
</tr>
<tr>
<td>SMME</td>
<td>Serengeti-Maasai Mara Ecosystem</td>
<td></td>
</tr>
<tr>
<td>SRAPs</td>
<td>Subregional and regional action programmes</td>
<td></td>
</tr>
<tr>
<td>SWAC</td>
<td>Sahel and West Africa Club</td>
<td></td>
</tr>
<tr>
<td>TBNRM</td>
<td>Transboundary Natural Resource Management</td>
<td></td>
</tr>
<tr>
<td>TPAs</td>
<td>Transboundary protected areas</td>
<td></td>
</tr>
<tr>
<td>TPN</td>
<td>Thematic Programme Network</td>
<td></td>
</tr>
<tr>
<td>UNCCCD</td>
<td>United Nations Convention for Combating Desertification</td>
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</tbody>
</table>

UNDP –DDC United Nations Development Programme-Drylands Development Centre
UNEP United Nations Environmental Programme
WCLP Wildlife Conservation Lease Programme
WOCAT World Overview of Conservation Approaches and Technologies
CHAPTER 1: AFRICAN RANGELANDS: CONTEXT AND CHARACTERISTICS

According to the UNCCD, drylands include the arid, semi arid and dry sub-humid zones and cover about 41 per cent of the globe. Rangelands are an important resource of the world’s drylands and generally include natural grasslands, savannah, shrublands, most deserts, tundra, alpine communities, coastal marshes and meadows. They make up 43 per cent of Africa’s inhabited surface and are home to 268 million people and 40 per cent of the continent’s population. An estimated 50 million pastoralists and up to 200 million agro-pastoralists live in drylands from West to East Africa (Helen de Jode, 2009). Figure 1 below shows the extent of drylands in Africa.

Figure 1. Map giving the extent of drylands in Africa
Source: (Digout, 2005)
Africa's rangelands comprise mostly the woodlands/shrublands and grasslands land cover classes (Hoffman and Vogel, 2008). In the drylands of East Africa, annuals and dwarf shrubs account for a greater proportion than perennial grasses of the diet of the nomadic pastoralists’ livestock. The rangelands of the Sudano-Sahel and West Africa are dominated by annuals and dwarf shrubs, with perennial grasses common in depressions where soil moisture is high, while the vegetation of Southern Africa is mostly savanna whereas in the Mediterranean zones, annual grasses and trees are key components (Oba et al., 2000).

Drylands are characterized by low and variable (both inter-annual and seasonal) rainfall, fairly high social and natural diversity and use of common property arrangements for resource management and access. African drylands receive less than 1000 mm of rainfall per year in less than 180 days, the remaining months being relatively or absolutely dry. Moreover, high temperatures during the rainy season cause much of the rainfall to be lost in evaporation while high intensity of storms causes high run-off leading to floods (Mwangi and Dohrn, 2006). East Africa experiences bimodal rainfall while West Africa receives mostly summer rainfall influenced by the Inter-Tropical Convergence Zone (ITCZ). Rainfall in Southern and East Africa is influenced by trade winds from the Indian Ocean and by weather patterns associated with sea surface temperatures and the El Niño Southern Oscillation and La Niña Oscillation (Oba et al., 2000).

The African rangelands are home to diverse cultures and traditions. Pastoralists are the central custodians of the rangelands and through their way of life and culture, have been the managers of resources in these drylands. The pastoral systems have been characterized by high mobility and dynamism as well as complex information systems and high dependency on local knowledge (Convention on Biological Diversity-CBD, 2010) to manage a highly diverse and complex environment, given the highly spatial and temporal variability of the resources in the drylands.

The equilibrium and non-equilibrium paradigms in rangeland management. Rangeland management knowledge has evolved over time. There are currently two paradigms in the ecology and management of arid and semi-arid rangelands- equilibrium and non-equilibrium models (see Box 1 for a summary of distinguishing characteristics). The equilibrium theory is premised on the notion that every rangeland has set a vegetation ‘carrying capacity,’ defined by rainfall and soils, which determines how many livestock it can support. This notion implies ecosystems where climate patterns are generally reliable and hence can allow plant and animal populations to reach some sort of equilibrium (Little, 2002). In essence, for the equilibrium environment, the primary goal of rangeland management has been to measure carrying capacity for various uses (Okayasu et al., 2011) whereby stocking rates are limited to match with plant biomass. Hence the debate on African traditional range management was previously revolving around carrying capacity, land degradation and desertification (Mwangi and Dohrn, 2006).

**Box 1. Summary of distinguishing characteristics of equilibrium and non-equilibrium systems**

<table>
<thead>
<tr>
<th><strong>Equilibrium system</strong></th>
<th><strong>Non-equilibrium system</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ecological implications</strong></td>
<td><strong>Economic goals are commercial</strong></td>
</tr>
<tr>
<td>Climate stability</td>
<td>Climate variability</td>
</tr>
<tr>
<td>Predictable primary production</td>
<td>Variable primary production</td>
</tr>
<tr>
<td>Livestock population controlled by density dependent factors</td>
<td>Livestock population controlled by density independent factors</td>
</tr>
<tr>
<td>Change in stocking density creates predictable changes in plant composition</td>
<td>Livestock track unpredictable forage production</td>
</tr>
<tr>
<td>Potential carrying capacity can be predicted and stocking density can be regulated according to potential carrying capacity</td>
<td>Prediction of potential carrying capacity not useful; uncertainties dominate future events.</td>
</tr>
<tr>
<td><strong>Management implications</strong></td>
<td><strong>Development implications</strong></td>
</tr>
<tr>
<td>Management oriented towards a single species of livestock</td>
<td>Management of multi species herds; sheep, goats, camel and donkeys.</td>
</tr>
<tr>
<td>Conventional range management appropriate</td>
<td>Opportunistic land use more suited</td>
</tr>
<tr>
<td>Grazing can be ascribed to planned systems</td>
<td>Grazing follows opportunistic strategies; mobility is an adaptive strategy</td>
</tr>
<tr>
<td>Strict regulation of stocking rates</td>
<td>Opportunistic stocking</td>
</tr>
<tr>
<td>Resource secure from land reforms</td>
<td>Resource have user rights</td>
</tr>
<tr>
<td>Land has collateral value</td>
<td>Resources lack collateral value</td>
</tr>
<tr>
<td>Clementsian succession and other equilibrium models suited</td>
<td>State-and-transmission and the climate-plant-herbivory interactive models apply</td>
</tr>
</tbody>
</table>

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2 | African Union - Interafrican Bureau for Animal Resources | 3 | African Union - Interafrican Bureau for Animal Resources
### Equilibrium system
- Management goals maybe influenced by market
- Benefits are in financial terms

### Non-equilibrium system
- May be averse to market forces
- Benefits are in reproductive capital

Source: (Oba et al., 2000)

However, a new approach challenging the equilibrium theory is driven by the realization that most dryland ecosystems are far from equilibrium systems, and hence are considered non-equilibrium systems, which represent most of the African rangelands. This new model or ‘new range ecology’ asserts that non-equilibrium environments are often characterized by fluctuations in climatic parameters such as rainfall and the associated fluctuations in plant biomass. Thus the aim of non-equilibrium rangeland management is to support the ability of herders to respond to their unpredictable environments, which calls for support to adaptive management (Okayasu et al., 2011). Among the strategies adopted by pastoralists to cope with uncertainties is opportunistic stocking strategies and mobility through nomadism and transhumance (Thebaud and Batterbury, 2001; Vetter, 2005). Opportunistic grazing movements enable pastoralists to gain access to heterogeneous and unpredictable pasture resources, helping them to overcome spatial and temporal variation of the resources.

Although each of the above concepts has been considered useful within certain contexts, both have limitations in application in the management of African rangelands. The equilibrium concept in the past failed to reverse range degradation by controlling stocking rates in an environment characterized by high temporal and spatial variability of resources as is common in African rangelands. It is also noted that uncritical adoption of non-equilibrium solutions can encourage land managers to ignore the need for sustainable management (Okayasu et al., 2011). Though the non-equilibrium theory takes care of variability, it faces challenges that restrict mobility in rangelands. Mobility in rangelands continues to be undermined by: a) on-going land fragmentation catalyzed by policy that favours privatization of communal land/resources and sedenterization; b) increasing population pressure; and c) breakdown of traditional knowledge and coping mechanisms which is part of a critical management tool for coping with spatial and temporal variability. The non-equilibrium state therefore makes it hard for pastoralists to track the environment and plan defined movements.

According to a recent review on rotational grazing system, one of the pillars in conventional rangeland management, research on this topic and range management practices have focused on both the social and biophysical factors in rangeland grazing management. In view of this challenge, rangeland experts are recommending an adaptive management approach that integrates scientific and experiential as well as the social and biophysical knowledge for a more comprehensive decision-making framework (Briske et al., 2011). This recommendation appears to support the Savory Theory of holistic decision-making approach that relies on various tools for managing rangeland ecosystems that includes: human creativity, technology, rest, fire, grazing, animal impact, living organisms and money and labor to achieve sustainable rangeland ecosystems management (Savory and Butterfield, 1988; Adams, 1999). (http://en.wikipedia.org/wiki/Holistic_management)

In conclusion, recent studies suggest that most arid and semi-arid rangeland systems are characterized by both equilibrium and non-equilibrium states at different scales, which implies a management approach that takes into account temporal variability and spatial heterogeneity (Okayasu et al., 2011; Vetter, 2005). It is therefore, prudent to adopt more holistic approaches that reflect the realities of African rangelands and take into account the on-going global and local scale changes (for example environmental, policy, demographic, political and economic). This also calls for adaptive management which applies guidelines and principles in a continuous iterative process, instead of prescriptions that do not allow necessary flexibility in rangelands management.
CHAPTER 2: THE IMPORTANCE OF DRYLANDS

Drylands, though generally perceived by many to be of low significance, have supported people’s livelihoods for thousands of years. There is a growing recognition of the importance of drylands, for example in meeting global food security as well as other needs of dryland and non-dryland populations (Mortimore, 2009). As earlier mentioned rangelands cover a significant part of Africa’s land area and host a significant proportion of the African population. With the current demographic trends, rangelands and all drylands in general will continue to experience increasing population and settlements as population growth demands more space that seems only available in the drylands. In addition, rangelands represent diverse ecosystems, natural resources, people/societies and multiple uses and functions and are therefore vital for the ecological, environmental, economic and social functions they play. Rangelands support life for those living within them and also for those living outside them. Key economic activities supported by rangelands include livestock production, dryland agriculture, wildlife conservation and related activities and to a lesser extent mining.

The drylands are predominantly used for livestock production, mainly through pastoralism. In sub-Saharan Africa alone, 25 million pastoralists and 240 million agro-pastoralists depend on livestock as their primary source of income. The region holds a 12.5 per cent share of the world’s meat production, a large part of which originates from drylands (FAO, 2009). In sub-Saharan Africa about 16 per cent of the population relies on pastoralism which contributes significantly to the Gross Domestic Product (GDP) of many nations, for example, approximately 8.5 per cent in Uganda, 9 per cent in Ethiopia and 10 per cent in Mali (CBD, 2010). In the Sahel region in countries such as Burkina Faso, Chad, Mali, Mauritania and Niger, transhumance pastoralism (which is the dominant feature of pastoralism in the region) contributes an estimated 70 per cent to 90 per cent of cattle reared (Kamuanga et al., 2008).

In terms of ecological significance rangeland vegetation helps protect often-fragile soil profiles, store carbon, provide habitat for wild fauna and flora, and acts as catchments or watersheds for large river systems (Lund, 2007). It is estimated that rangelands store up to 30 per cent of the world’s soil carbon in addition to the substantial amount of above-ground carbon stored in trees, bushes, shrubs and grasses (FAO, 2009). Drylands are also vital in water regulation and provision and host a diverse range of perennial, seasonal or ephemeral wetlands (Tooth and McCarthy, 2007), some of which
are of international importance e.g. the Nile Basin. Wetlands in drylands are important for pastoralists particularly for dry season grazing or during drought, and are also vital for crop production. Rich biodiversity of both plants and animals also reside in the drylands. In fact, a large number of crop genetic materials is known to originate in drylands e.g. many food crops, such as wheat, barley, sorghum and millet. Drylands are now also popular tourism destinations, backed by rich wildlife, unique landscapes (e.g. rocky terrains), and significant cultural and spiritual shrines.

The socio-economic dimension of drylands is characterized by higher than average levels of poverty and are home to the most marginalized people. Hence, sustainable dryland management and development are key in achieving the MDGs particularly poverty reduction and environmental sustainability. For instance, in Kenya the highest incidence of poverty is found in the arid and semi-arid lands, where more than 65 per cent of the population lives below the poverty datum line (Mwangi, 2009). Poverty is both an effect and cause of environmental degradation – an effect of degradation as a degraded ecosystem provides fewer goods and services, and a cause of degradation as people strive to eke out a living from a diminishing and variable resource base. The relevance of development in drylands is underscored by the suffering of its people as is reminiscent of drought and flood effects and aggravated by climate change. Is humanitarian aid the solution to these challenges? Drylands cannot be ignored. The battle for poverty eradication must recognize the importance of sustainable management and development of the drylands. In addition, the Universal Declaration of Human Rights expects the international community to address the plight of marginalized people living in the drylands.

Although the role played by rangelands in life support systems now seems obvious, until recently only a few governments and societies understood their values. The dynamics of rangelands are still not yet fully understood by policy makers, development agents and communities and hence inadequate importance has been attached to them although impacts of misuse are clearly seen by observers. This lack of knowledge has been reflected also in national economic data which give more emphasis on agriculture in arable land with little being mentioned about the contribution of drylands.

CHAPTER 3: KEY AND EMERGING ISSUES IN RANGELAND MANAGEMENT IN AFRICA

Drylands all over the world have undergone changes, albeit at different rates and nature for different regions. Although dryland communities (pastoralists in particular) have always lived with change, the current pace and scale of change is unprecedented (SOS, 2009). Changes in land use and productivity, population, water resources and climate among others, have occurred and will continue to do so. There are direct and indirect drivers of this change, which include biophysical and socio-economic factors. The indirect anthropogenic drivers of change include demographic drivers (e.g. local population growth); economic drivers, such as local and global market trends; and socio-political drivers, such as local and regional land tenure policies; as well as scientific and technological innovations and transfer. The interplay of these forces normally leads to reduced land productivity due to intensified pressure on rangelands (www.millenniumassessment.org). Though drylands offer significant potential for socio-economic development, they are caught in a spiral of deforestation, fragmentation, degradation and desertification (FAO, 2010). Further details on the current status, underlying issues and dynamics of the rangelands are discussed in the succeeding section.

3.1 Land tenure and property rights

Property rights regimes over much of Africa comprise multiple and overlapping rights that are authorized by multiple institutions across different jurisdictions (Mwangi, 2009). This is also reflected in the rangelands where natural resources are owned, managed and used collectively by different users often under different tenure arrangements (IIED and SOS, 2010). The type of land tenure determines the rights of use and access to land and hence play an important role in determining the land management options available to users. Changes in land tenure may alter the behaviour of individuals and local communities, leading to land degradation, for example, overgrazing following the settlement of nomads. Insecure property rights and inappropriate policies on land use have exacerbated the problem of rangeland degradation in Northern Africa. Like in other African countries, the region is suffering from a breakdown of the traditional institutions that govern access to grazing lands, leading to an ‘open access’ scenario characterized by lack of corresponding regulatory mechanisms to control grazing (Tiedeman, 2005). Evidence suggests that for multi-users resources like the drylands, tenure regulation should focus on the process (rules and mechanisms for regulating access and use among multiple interests) rather than the substance (allocation of rights themselves) (Mwangi and Dohrn, 2006).
The privatization of land appears common to both the Sahelian and East African rangelands, where tenure favours farming in the Sahel and in East Africa, and policy makers have a preference for privatization of land. While in the Sahel farmers have increased pressure to privatize resources leaving out the herders, in East Africa there is (increased) subdivision of rangelands that has led to declines in wildlife and livestock numbers (Mwangi, 2009). In Côte d’Ivoire, adoption of land privatization policies has led to the advent of new land use patterns and management practices with implications for curtailed livestock mobility for the Fulbe pastoralists (Bassett, 2009). In Niger there is evidence of changing modes of access to water and pasture, culminating in present-day tensions and conflict between pastoral groups (Thebaud and Batterbury, 2001); while in Northern Nigeria Fulani pastoralists are faced with an 8 to 10 per cent decline in the size of their rangelands due to appropriations by Hausa farmers and Fulani agro-pastoralists (Mwangi and Dohrn, 2008). The impact of this individualization has increased conflict, impoverishment of herders and degradation of the environment. A successful synergistic relationship between livestock-based livelihoods and environmental health requires that constraints related to lack of tenure, resource privatization and minimal social services (health and education) and security issues are addressed (FAO, 2009).

3.2 Conflicts and insecurity issues
Conflicts, insecurity and instability (political/social) are among the challenges facing drylands management in Africa, particularly in the Sahel and Eastern Africa regions. Conflicts and insecurity contribute to degradation in the drylands. Civil wars and banditry have displaced communities and confined some within limited areas than is traditionally available, leading to land degradation due to over-use of rangeland and water resources. The concentration and higher number of refugees has increased pressure on resources especially on grazing resources as some migrate with their animals, and the need for fuelwood and building materials that has resulted in increased tree-cutting. The source of the conflicts have been attributed to a gradual erosion of the authority of the elders, the failure of the state to provide security, the proliferation of small arms and greater integration into the national political and economic sphere (Guyo et al., 2003). Poorly adapted or ambiguous land rights have also been blamed for land-related conflicts. Conflicts related to natural resources call for the embedding of natural resource governance in social relations as well as morals in pursuit of peace and justice.

3.3 Wildlife-livestock interaction
The rangelands host a rich diversity of wildlife, which is found both in protected areas and outside protected areas (in community land). The pastoralists and wildlife have co-existed harmoniously for a long time in the African drylands, where livestock often share (in a mutually beneficial manner) grazing lands and habitats with wildlife ungulates. Most the interaction between livestock and wildlife is outside protected areas. The face of this interaction is now changing due to a changing landscape, with more competition for finite resources (water, pasture and migration routes) leading to increased contact between wildlife and livestock (Ososky et al., 2005). The underlying problem is loss or decline in wildlife habitats. The impact of this is increased wildlife-livestock-human conflicts arising from damage caused by livestock, humans and wildlife to each other. The question of compensation for the opportunity cost of living with wildlife is therefore central to conservation of wildlife. Despite this challenge, there is a growing recognition that harmonious co-existence between wildlife and livestock is possible (AU-IBAR and UNEP, 2009) and the integration of livestock production and wildlife is already taking place among some pastoral communities where communities are expected to receive more benefits from wildlife conservation (IFAD, 2004). On a pilot basis, the African Union -Interafrican Bureau of Animal Resources (AU-IBAR) implemented the Dryland Wildlife Livestock Environment Interface Project to improve community livelihoods, enhance biodiversity conservation and mitigate dryland land degradation (AU-IBAR and UNEP, 2009). Lessons learnt and good practices have been documented for upscaling in other relevant drylands in Africa. Wildlife has a great economic contribution, especially as one of the main tourist attractions and hence prudent management of the rangelands should include wildlife and livestock sharing the same landscape.

3.4 Mobility of pastoralists and livestock in drylands
Various land use systems are practiced in the rangelands, with livestock production being the major economic activity. Pastoralism is the key production system practiced in the world’s drylands. Out of an estimated 120 million pastoralists worldwide, 50 million reside in sub-Saharan Africa (Nikola, 2006). Due to the high spatial and temporal variation in rainfall in the rangelands, mobility and capacity to access a wide range of resources is necessary in order to cater for the scarcity of grazing and water resources for livestock and wildlife. Among the key limitations to rational use of rangelands identified during the initiation of TPN3 was the disappearance of trans-boundary movements and nomadic livestock corridors, which implied need for a pastoral code at national and sub-regional levels, supported by a clear land use rights (UNCCD, 2001). Though previously ignored, mobility for both livestock and wildlife has caught the attention of African governments and there are efforts to formulate...
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settlement triggered by the provision of food relief as was observed in Turkana, Kenya. The trend has led to concentration of people in some areas resulting in degradation due to overgrazing and deforestation whilst other areas such as grazing lands are abandoned (Darkoh, 1990). As a result, the resilience of these communities is clearly undermined, particularly by some of the humanitarian activities that do not seek to strengthen the pastoral natural resource management (NRM) and sustainable livelihoods strategies.

Owing to the challenges related to adverse climate change effects (droughts, famine), unsupportive policy environment that restricts mobility of pastoralists due to land fragmentation, insecurity (cattle rustling) among others, pastoralists are adapting to these changes albeit in a manner that weakens rather than sustains their resilience. This is reflected in the trend towards permanent settlements to engage in farming to meet food security needs, reliance on relief food and most significantly some are completely abandoning pastoralism to work in towns and engage in business as ways of mitigating the effects of environmental shocks and in reducing dependence on livestock-based livelihoods.

3.5 Land degradation in drylands

Majority of the drylands in Africa suffer various forms of environmental degradation and at varying degrees, including desertification, soil erosion (Figure 3), destruction of wildlife habitats, loss of biodiversity, salinization of irrigated areas, and soil compaction. The degradation of biophysical rangeland resources has serious implications to the pastoral ecosystems, livelihoods and livestock production. In addition, water resources are dwindling due to overuse and lack of appropriate policies to protect or use them efficiently. The drylands are the most affected with an estimated 75 per cent of Africa’s drylands being affected by desertification and land degradation of a moderate to high degree (Olukoye and Kinyamario, 2009). Figure 4 Rangeland degradation is often attributed to anthropogenic influences (e.g. overgrazing and mismanagement of resources by pastoralists) as the primary force driving degradation (WISP, 2008 and Li et al., 2011). Despite the obvious rangeland degradation and...
the consequences it is likely to have as a result of loss of ecosystem services, rangeland degradation is less understood by policy makers, development planners and researchers and is often confused with desertification, influenced by biases of western knowledge (Kassahun et al., 2008). A new and growing cause of environmental degradation in drylands is the damping of industrial and urban wastes due to poor waste management in most African countries and the fact that drylands appear like lands which are ‘open for all’.

Rangeland degradation undermines the ability of dryland communities to cope with the challenge of a complex and dynamic system. In North Africa, rangelands and natural pastures are experiencing high degradation, thus reducing their contribution to livestock feed for example, in Tunisia, the contribution of rangelands to livestock diet has decreased from 65 to 10 per cent (Karrou and El Mourld, undated). As observed in Ethiopia, pastoral systems are losing resilience as traditional coping mechanisms are said to be failing due to increasing environmental and rangeland degradation and lack of national polices to address the problem (Kassahun et al., 2008). In North Africa rangelands, demographic and economic pressures have led to widespread use of erosion promoting cropping practices that are associated with declining soil fertility and inadequate feed supply for livestock (Bounejmate et al., undated).

3.6 Land use changes and land fragmentation

Human actions cause landscape fragmentation as a result of changes in land tenure and land-use practices (Hobbs et al., 2008). The causes of land fragmentation are complex and interlinked and no single group of actors can be blamed. Governments and local communities’ leadership have their share of contribution but ultimately the government is held responsible for failure to institute protective measures (Flintan, 2011). A common type of fragmentation is the conversion of one land cover type to another e.g. habitat transformation due to residential and urban development, establishment of ranches, commercial /large scale agriculture and encroachment by invasive plant species (Flintan, 2011).

The general trend in East Africa has been towards land privatization, and fragmentation of former communal holdings (e.g. group ranches) (Olson, 2006). Rangelands are becoming more and more fragmented due to both external (e.g. government policy) and internal factors like communal leadership.

The picture is the same in other parts of Africa e.g. North Africa livestock production and wildlife: case of where pasture practices are Kajiado, Kenya disappearing and are replaced with agro-pastoral systems characterized by intensification of livestock production, cropping and consequent degradation of being inevitable. natural resources including genetic erosion of native perennial grasses systems to more intensive production. The land use conversion of wetter and more productive rangelands into Farming, may have led to higher land productivity in monetary terms but the gains are offset by the reduced productivity of livestock and wildlife systems as the areas become inaccessible to both (Olson, 2006).

The above pressures have resulted in reduced access by herders to vital grazing and water resources (Olson, 2006 and Hobbs et al., 2008), competition over
resources between herders and wildlife, sedenterization of pastoralists, and increases in the intensity of resource use in areas where water and grazing remain accessible (Olson, 2006). As has been observed in the famous Mara Game Reserve in Kenya, there are increased settlements due to increased pastoralist population, with imminent further subdivision of land likely to seriously affect the wildlife/livestock interactions and eventual exclusion of wildlife (Lamprey and Reid, 2004). It is accepted that fragmentation in rangelands often occurs due to changes in land tenure (Hobbs et al., 2008). However, the impact of this fragmentation is still not well studied although they are visible, and hence the need for better understanding of its causes and effects.

3.7 Population status and trends

Africa’s population growth rate is one of the highest in the world, with most of the people being rural based and reliant on the natural resources/land for their livelihood. Consequently, demographic pressure on rangelands is increasing both due to increases in the population of pastoralists and migration from non-pastoral areas into rangelands. This is evidenced by the increasing and growing settlements in the drylands as well as establishment of urban centres. As being witnessed, the trend is to co-opt, rather than integrate, pastoralist resources (land) into the cash and market economy, and a diversification of livelihoods within the arid and semi arid lands (ODI, 2009b). A case in point is in East Africa where pastoral areas are also the site of increased population migrations from densely populated areas and are experiencing greater urban expansion and competition with commercialized agriculture, especially the more recent introduction of capital intensive investments such as flower farming (Mwangi, 2009). Clearly demographic pressure on rangelands is increasing and consequently livestock based production systems and wildlife conservation are under strain due to loss of critical ecosystems such as wetlands that are vital as dry season grazing areas, as sedentary farmers and wealthy pastoralists are blocking the access to these points by others (IFAD, 2004). Ultimately, the loss of rich pastures is impeding pastoral mobility making pastoralism less viable as poor pastoral communities also turn to growing crops to feed their families, further undermining the pastoral system (IIED and SOS Sahel, 2010).

As space (land) and resources available in arable, high potential areas continue to diminish, population spill-over and growth into drylands seems inevitable. To mitigate against dire environmental consequences of population pressure in drylands will require comprehensive and flexible planning to accommodate settlements as an emerging land use in the rangelands.

3.8 Institutional, governance and policy environment

Formal and informal (traditional) institutions in African drylands have co-existed and evolved over time. These institutions have been very instrumental in governing rights to water, land and rangeland resources, as well as in conflict resolution. Pastoralism has been and continues to be the dominant land use system in Africa’s drylands. A key feature of the pastoral system is the strong social organization and customary institutions that have helped pastoralists to adapt to uncertainty and due to their flexibility have contributed to enhanced resilience in rangeland ecosystems (WISP, 2007). Control of access and management of dryland resources under traditional institutions has over time been weakened mainly by unsupportive policies and a tendency for state-centric NRM common in Africa. However, the on-going process of democratization and devolution of power and resources is likely to have a positive impact on NRM in drylands, but care must be taken to protect the vulnerable, voiceless and marginalized people and groups. The role played by the community in governance of natural resources has also gained more recognition and supportive policy is in place in some countries. For example, sectoral policies for forest and water in Kenya acknowledge and provide a framework for participation of communities and other stakeholders in resource management. This trend is also reflected through the emergence of community-based natural resource management (CBNRM).

Pastoral development policies and institutional set ups in Africa have evolved, with considerable differences across countries and the perceptions that pastoralism using communal rangelands was inefficient, had low productivity, and caused environmental degradation, led to pastoral policies that tended to favor sedenterization rather than promote pastoral mobility, resulting to widespread appropriation of pastoral rangelands, especially in Eastern and Southern Africa. However, due to better understanding of pastoral systems, this perception has changed and pastoralism is being viewed as a rational way (both economically and ecologically) of using the rangelands. Governments have thus developed policies and legal frameworks in support of pastoralism. For instance, efforts are being made to reverse the trend of weakening customary institutions (WISP, 2007c). However this new knowledge is yet to influence policy development in a significant way and pastoralists continue to suffer consequences of inadequate policy and practice (SOS, 2009). National and regional policies guiding drylands management and development need also to establish a balance between pastoralism and agriculture.
More efforts are still needed today to incorporate pastoralism into the mainstream economy by undertaking reviews of a wide range policies and making relevant changes, informed by a better understanding of the drylands. Opportunities for enhancing pastoral lifestyle in Africa through policy and institutional frameworks continue to emerge, for example, the on-going progressive regional integration where recognition of the need for mobility of pastoralists across border should be given. The Economic Community of West Africa States (ECOWAS) has set the pace by providing a legislative framework for cross border mobility, in the form of an International Transhumance Certificate to be used by pastoralists in fifteen member states (IIED and SOS, 2010). For the COMESA region, there is a 2009 draft policy framework for food security in pastoral areas, which seeks to harmonize national policies to support pastoral movement and efficient use of transnational rangeland ecosystem, and promote livestock trade (African Union, 2010). The East African Community (EAC) recently developed the EAC Transboundary Ecosystems Management Bill, to provide for the management and regulation of Transboundary Ecosystems in the EAC (EAC, 2010), which is expected to enhance management of rangelands particularly with regard to wildlife, pastoralism and water resources. At continental scale, the African Union is developing a Pan African pastoral policy framework which aims to secure, protect and improve the lives, livelihoods and rights of African pastoralists (African Union, 2010). Whilst the draft Framework Guidelines for Land Policy in Africa underscores the need to enhance access to land through tenure reform, particularly for vulnerable groups such as women, establishment of a process for resolution of cross boundary disputes which will help to protect grasslands and pastoral ecosystems (African Union, 2009). Pastoral issues in Africa are also being captured within the bigger framework of climate change adaptation as drylands are among the hardest hit by effects of droughts, floods and famine.

3.9 Global context and trends

Life is an interdependent and interactive system as exemplified in the interconnectedness of global ecosystems. Both human and natural factors interact at the local and global scale. The drylands interact with global economic, political and environmental components and processes, such as trade, tourism, migration and environmental services like carbon sequestration and hence the effect of the interaction is local and global in scale. As observed, large-scale climatic and anthropogenic factors often have synergetic effects on dryland ecosystems and changes in one of these render the ecosystem more sensitive to changes in the others (Puigdefabregas, 1998). It is projected that African rangelands will be more negatively affected by climate change, with implications such as change in water resources, change in rangeland productivity, change in land use systems and rangeland-based livelihoods (Hoffman and Vogel, 2008). Climate change is seen as a key ecological driver that influences the dynamics of sub-Saharan rangelands (Oba et al., 2000) and hence is likely to also affect mobility trends, locally and internationally as pastoral systems transcend national borders. A combination of factors, key among them climatic shocks, is pushing more and more pastoralists out of the system (ODI, 2009c), the situation being exacerbated by limited livelihoods alternatives. Changes in market conditions can also trigger land use changes that increase the vulnerability of land to climate fluctuations, for instance, per capita exploitation rate of natural resources – high per capita exploitation will result in increased pressure on the ecosystem services and goods.

Modern advances in technology, transport and communications have brought about rapid changes which have affected natural resources, and the cultures and life styles of the inhabitants of dryland areas. In particular, advances in telecommunication technology have provided new platforms for integrated management of the local dryland communities with the global village. The ‘modern’ pastoralists in Africa, for example, have better access to livestock information system (e.g. disease surveillance and marketing), thanks to the availability and affordability of mobile communication technology (mobile phones). This combined with mobile money transfer and access to credit has the potential to transform livelihoods through enhanced and enlarged market systems and ultimately affect how rangelands are managed.

Foreign Investment in Agriculture in Africa: Recent years have seen a surge of interest in international investment in Africa’s agriculture, mainly through acquisitions of agricultural land by investors from various Gulf States, China and Korea, for food production (Hallam, 2009). Investment companies in Europe and North America are also exploring similar opportunities. Some African countries have made effort to encourage international access to land resources whose ownership and control has previously been entirely national or community owned. Much of the land available for foreign investment in drylands is likely to be in high potential rangelands where irrigation farming is possible. Land leases normally cover 10,000 to 500, 000 hectares and are valid for 99 years (Hallam, 2009). This trend poses a serious challenge for pastoralism and agro-pastoralism in the future, with environmental impacts including soil degradation (desertification), depletion of water resources, blockage of migration routes and reduction in land available for pasture.
3.10. Misconceptions about drylands

Drylands have often been misconceived by many as empty and barren, and hence of little significance. This is mainly due to lack of awareness and understanding of the dynamics and contributions of dryland ecosystems, and hence investment and development policies in these areas have too often been informed by myths and stereotypes. Ultimately, this has impeded the understanding of sustainable development in drylands. Mortimore et al. (2009) elaborates on the misconceptions (under the common myths) about drylands and explains how to counter them. Some of the myths highlighted include the notion that drylands cannot yield a satisfactory return on investment owing to high variability in rainfall, and that dryland communities are helpless in the face of climatic variability and change. Another misconception is that indigenous management practices have often been destructive and that reducing the human population can alleviate the problem of degradation (UNDP, 2008). Such views have only served to sideline the drylands and its communities from the mainstream development process. Overcoming the barriers posed by these myths will be critical in expanding the opportunities for dryland development in Africa. This calls for increased knowledge in dryland ecosystems especially among policy makers, development agents and scientists.

CHAPTER 4: BEST PRACTICES IN SUSTAINABLE USE OF RANGELANDS AND FODDER CROP DEVELOPMENT

It is widely acknowledged that for sustainable development to be realized, the environment and natural resource base upon which development relies must be sustainably managed for the current and future generations. The concept of sustainable land management (SLM) or more specifically, sustainable NRM has over the years drawn attention and attempts have been made to define SLM. As defined by TerrAfrica (2009), and for the purposes of this book, best practices in SLM should “increase land productivity and maintain ecological resilience, be cost efficient with short payback (economic viability), easy to learn, accepted, effectively adopted and taken up (socially and culturally accepted), and should be environmentally sustainable (contributing to the improvement of soils, water, and flora and fauna (biodiversity))”.

As envisaged within the UNCCD TPN3, the network was to facilitate the exchange and sharing of technologies, information and experiences as well as provide for a mechanism to harmonize and coordinate policies with regard to combating desertification in Africa. It is acknowledged that whilst there is a sound understanding of the biophysical process of land degradation and an appreciation of the numerous technologies and improved SLM strategies, implementation and replication of these strategies is uncommon (UNEP, 2010). A wealth of experience in SLM already exists but has not yet been adequately tapped and shared (Schwilch et al., 2009), and due to lack of formal communication pathways among institutions, some of the lessons learnt have been confined to the agencies involved and often getting lost at the close of projects and programmes (IFAD, 2004). The building up of a common pool of knowledge related to SLM technologies and approaches for implementation and dissemination provides the basis for successful upscaling (TerrAfrica, 2009). It is therefore hoped that the documentation and dissemination of some of the key lessons and best practices in promoting rational range use in Africa’s drylands will serve to spur adoption and scaling up of the practices among relevant actors, particularly governments, development agencies and local communities. The following section highlights some of these best practices and lessons learnt from previous work in drylands. Also see Annex 1 for a summary of views of key stakeholders (national, sub-regional and regional institutions) contacted in the process of identification and documentation of good practices in rangelands management in Africa.
4.1 Grazing management
The basic principles of range management require the maintenance of livestock numbers with available forage supply, uniform distribution of animals within the range, vegetation maintenance through alternating periods of grazing and rest, and use the most suitable kinds of livestock. The connection between land degradation and livestock management is an acknowledged problem in the arid and semi arid areas, calling for improvements in livestock management strategies and hence enhancing grazing management best practice is important for sustaining the productivity and health of rangelands (Illius et al., 1998 and Ash et al., 2011). In degraded rangeland, the reduction of stock number and controlled grazing has been recommended to lower grazing pressure in order to facilitate rehabilitation (Wessels et al., 2007 and Li et al., 2011). As alluded to by Woodfine (2009), the target of SLM in pasture and range management is maximization of the capture, infiltration and storage of rainwater into soils, which promotes favorable conditions for increased vegetation cover, soil organic carbon, and resulting in sustainable utilization of above and below ground biodiversity.

Controlled grazing management practice is considered beneficial in conditions of poor vegetation cover, overgrazing and degraded soils, and is considered as the most promising SLM practice to restore degraded rangelands as it enhances the vigor of mature perennial grasses. Sustainable grazing management is already being used in Namibia, South Africa, and the Northern Rangelands of Kenya and Ethiopia (Woodfine, 2009). As shown in Box 3, the practice is deemed sustainable due to community ownership, enhanced institutional capacity at local level and perceived benefits (ecological and economic), among other factors (see AU-IBAR and UNEP, 2009).

Box 3. Grazing management in community conservancies in Kenya
AU-IBAR implemented the Dryland Wildlife Livestock Interface project in 2005-2009 to document the practice of livestock-wildlife interface management, grazing management strategy through community conservancy approach in among pastoral communities in northern Kenya (Kalama, Naibunga and Namunyak community conservancies) and West Arly national park in Burkina Faso. Communities were assisted to establish grazing management plans and grazing management rules (bylaws) to govern grazing resources within the conservancies, where both livestock and wildlife competed for resources. To enhance range condition, range rehabilitation through reseeding of degraded areas was also incorporated. The outcome was increased availability of grazing resources (forage and water) that enhanced both livestock production and wildlife in a complementary manner. A key component of success was the strengthening of the institutional capacity of the community through training and establishment of grazing bylaws that were enforced by a committee in Kenya. This success attracted enthusiasm from other pastoral communities who began to replicate the practice. The practice is being promoted in former group ranches that have been converted into conservancies in Kenya.

The use of grazing practice as a management tool for enhancing range productivity and restoration needs to consider grazing history of the degraded rangeland. This is particularly important if the degraded grazing lands have a historical trajectory of large herbivores including livestock (Papanastasias, 2009). In case of rotational and deferred grazing, it is recommended that the partitioning of land should be based on ecological variation, and the timing and duration of grazing be worked out separately for each land type and for each grazing territory in order to account for biophysical variations - mainly soils and vegetation (Abel and Blaikie, 1989). Besides its significance in range restoration, improved grazing management will improve the functioning of the hydrological systems in drylands and contribute to the protection and restoration of biodiversity (Woodfine, 2009). Indeed, according to IUCN, unsustainable livestock management has been identified as a major threat to biodiversity of a high number of threatened species (Neely et al., 2010).

4.2 Integrated crop-livestock systems
The interaction between pastoral and agro-pastoral/agricultural communities has been one of interdependence, whereby pastoralists have benefited from agro-communities through gaining access to crop residues in their fields for their livestock whilst agricultural communities have benefited through fertilization of their farms from animal dung. Integrated crop-livestock farming systems have been shown to improve cycling of nutrients between rangelands, croplands and stall-fed (zero grazing or “cut and carry”) livestock production systems (Woodfine, 2009). This is done within a coordinated network of livestock management, fodder production and controlled grazing. It has been observed that crop residues may contribute to increased availability of better quality feed in the dry season and that livestock fed on crop residues perform better than livestock grazing natural pastures (Mark et al., 2004). Crop-livestock systems in drylands are found across many countries in Africa, more prominently in West Africa where it has evolved for a long time mainly among agro-pastoralists.
4.3 Livestock mobility in rangelands

Livestock production is the key production system in the African rangelands. Rangelands exhibit extreme spatial and temporal variability in the quality and availability of forage (O’Reagan and Schwartz, undated). Annual and seasonal variability in rainfall is an important cause of instability in semi-arid environments. Therefore, flexible and opportunistic management practices are required to realize the sustainable economic yield from rangelands (Illius et al., 1998). In this regard, mobility is an important way of coping with this seasonal and ecological/landscape variability. Pastoralism either in form of transhumance or nomadism involves livestock mobility and is viewed as an efficient system of livestock production in rangelands. Livestock mobility is vital for production, trade and survival especially during times of crisis, particularly drought and conflict (IIED and SOS, 2010) and hence contributes greatly to pastoral resilience. It has also been argued that under the same conditions, pastoralism is more productive than commercial ranching (WISP, 2007a) and presents a less risky and more robust investment opportunity because it has the potential to perform well where other livelihoods are likely to fail (ODI, 2009c). Pastoralism is highly compatible with conservation and makes the most of livestock opportunities within variable and unpredictable rangeland ecosystem (WISP, 2007b). In essence, livestock mobility is one of the key pastoralist risk management strategies which also promotes resilience of rangeland ecosystem. Besides, mobility is also important for trade particularly in livestock and livestock products, which significantly contributes to livelihoods in terms of food security among other benefits. It is reported that official livestock trade in West Africa is worth in excess of $150 million (IIED and SOS, 2010) and part of this has been supported by mobility through transhumance, with designated routes as indicated in Figure 6.

Negotiated arrangements (verbal or written) between neighbouring pastoral groups and non-pastoral groups (agriculturalists) make it possible for livestock owners to access wetter areas far beyond the usual animals’ grazing range especially in times of drought. Where semi-arid rangelands border on areas where crop production is possible, nomadic pastoralists and settled agriculturalists may have mutually beneficial arrangements where livestock use crop residues in the dry season, allowing the crop farmer to make use of manure (nutrient cycling) (Vetter, 2005). For example in the Sahelian zone, the practice where transhumance is based on peace agreements between respective traditional rulers is seen in the common exploitation of pastureland extending from the wet plains of the Logone River in the far north region of Cameroon to Lake Lere in Chad (African Union, 2010). This approach minimizes...
the possibility of conflicts which are a common feature particularly in drought situations (due to resource scarcity and displacement). It is therefore, prudent to ensure that there are in-built mechanisms for conflict prevention, management and resolution in programs that promote pastoral mobility.

In recognition of the importance of livestock mobility, some countries in Africa have started to put in place policy and legislative measures to facilitate the practice, for instance, through legislation to protect migration corridors and regulate livestock mobility thus creating official transhumance routes. A good example of this is the ECOWAS International Transhumance Certificate (ITC) that facilitates cross-border mobility of herders and livestock between its 15 member states in West Africa (IIED and SOS, 2010).

**Box 4. The International Transhumance Certificate (ITC)**

Transhumant pastoralists are required to produce the ITC to enter host country. The ITC is designed to ensure the sanitary conditions of local herds (transhumants must vaccinate their animals); provide information to host communities about the arrival of transhumant animals and time to prepare and respond; guarantee, through the laws of the receiving country, that the rights of nonresident herders will be respected and that the nonresidents transhumants must comply with the national legislation of the host country regarding access and use of forest areas, wildlife, water points and pasture among other things; and ensure a conflict resolution mechanism is put in place through a Conciliation Commission, which consists of herders, farmers, local authorities and others stakeholders (Concordis International, 2011). The ITC provides a way of improving how transhumance is organized and managed by taking into account animal movements, sustainable use of grazing resources, conflict management and environmental conservation all of which are key for livestock production.

A main challenge has been the poor implementation of ITC among member countries. Notwithstanding this, mobility will remain a critical adaptation mechanism in most African pastoral drylands, more significantly as climate change worsens an already highly unpredictable environment. Furthermore, the effects of a sedenterized population in drylands have been observed to cause deleterious impacts on the rangelands.

### 4.4 Rehabilitation and conservation of drylands

Rangeland degradation is a widespread problem throughout sub-Saharan Africa. The combined effect of human and climatic factors on land degradation has led to reduced production of the ASALs and reduced environmental quality (Jama and Zeila, 2005). Though restoration of degraded rangeland remains a challenge, studies have shown that degraded vegetation is able to recover in a relatively short time when protected (Yayneshet et al., 2009). Range rehabilitation/restoration measures take various forms, which include reseeding or allowing the progression of natural regeneration, soil and water conservation measures, water harvesting and dryland forestry. For rehabilitation to be effective and successful, it should target the underlying causes of degradation and reverse the degradation process (Li et al., 2011). The introduction of appropriate grazing management laws together with rehabilitation of rangelands by reseeding, supported by the use of water harvesting techniques, would contribute significantly to halting and reversing the land degradation and improving the carrying capacity of the rangeland.

Labour saving technologies such as tractor plough can be very useful in land preparation before reseeding (see Figure 7) but for upscaling, low cost reseeding technology such as use of a pitting machine is critical.

![Image](Image 7. Preparing land for reseeding using a tractor and seed broadcasting by hand, Tiermamut Group Ranch in Laikipia, Kenya.)

One common technique that has been successfully tested in restoring degraded rangelands is the use of enclosures whereby grazing is excluded for a specified period of time. Experience from Eastern Africa, for example Ethiopia, indicates that enclosures can be viable systems for restoration of degraded land if they have clearly defined users, resource boundaries and realistic rules established locally (Mengistu et al., 2005) . In Kenya, competition between livestock keepers for control of a diminishing range resource is fuelling the drive of range enclosure as the pastoralists attempt to do something about their declining resource base (Mureithi, 2011). However, there is need for understanding the effects of using enclosures under different circumstances to avoid creating new problems.

For effective control of degradation, management techniques involving prevention and rehabilitation are preferred over techniques of restoration which...
are often too expensive for widespread application (Puigdefabregas, 1998). In essence, prevention of rangeland degradation is preferred over rehabilitation not only in terms of cost but also due to the accelerating and reinforcing nature of rangeland degradation once it has reached a certain stage, and the possibility of irreversible effects (Jaap, 1990). With this in mind, it is critical that areas that are not yet degraded or are in fair condition are conserved and their productivity enhanced. As indicated in Box 5, linking rehabilitation and conservation to economic benefits is important for successful and sustainable rehabilitation efforts among communities.

Box 5. Linking range rehabilitation to economic benefits
The link between conservation and economic benefits is an important success factor in rehabilitation as communities rationalize the tangible benefits of their efforts- if no benefits are expected, it is difficult to convince them to invest in conservation just for intangible ecological benefits. In line with this, the AWF has been sponsoring range rehabilitation to address environmental degradation and loss of pastoral livelihoods in communal (group) ranches in Kenya. The outcomes have been increased forage for livestock and wildlife, and increased wildlife numbers and livestock carrying capacity. One way of improving pastoral livelihoods in project areas has been through targeting income generated through rehabilitation, whereby income is obtained from sale of grass seeds to aspiring communities and grazing fees charged to ranch members and non-members. In addition, the increased forage is used to fatten animals which are sold (for meat or re-stocking) fetching higher market price. This is realized through linking community groups undertaking rehabilitation to existing markets or livestock marketing partners particularly private sector, effectively linking rehabilitation to direct economic benefits for the community.

4.5 Agroforestry in the drylands
Agroforestry entails the integration of woody perennials with agricultural crops, pastures and livestock on the same land management unit (Rocheleau et al., 1988). Agroforestry has multiple benefits - it contributes to animal fodder, human food, and woodfuel, thus reducing pressure on rangeland resources. It also provides several ecosystem services that include climate change mitigation through carbon sequestration. The role of forests and woodlands in combating desertification and conserving watersheds are critical, especially for ensuring long-term food security (FAO, 2010). The integration of indigenous knowledge into agro-forestry for fodder production has been implemented successfully in various countries through the Ngitiri system.

As encapsulated in Agenda 21, adopted by world leaders meeting at the 1992 Rio Earth Summit, agroforestry has been identified as one way of rehabilitating degraded drylands of the world and enhancing their resilience. Since soil moisture is a limiting factor for plant growth in arid and semi-arid areas, it is recommended that agroforestry in drylands incorporates (rain) water harvesting (Jama and Zeila, 2005). Agroforestry opportunities exist to develop alternative income-generating enterprises, for instance high value fruit tree plantations at suitable locations using water harvesting and/or available groundwater, which reduces the pressure on grazing resources. Sustainable agroforestry in drylands needs a facilitative policy framework to secure land tenure as access to land and resource user rights are among key challenges in dryland resource tenure.

4.6 Fodder crop production and preservation
Scarcity of pasture associated with the temporal and spatial variability of rainfall and human interference in the rangelands continues to be a challenge for sustainable use of rangelands in Africa. According to FAO, there has been a reduction in pasture with the total land area under pasture and fodder having decreased in Africa, partially due to the fact that large grassland areas have been destroyed or converted to agricultural land. Demand for livestock feed in drylands has therefore increased.

Box 6. Cacti (Opuntia Spp) as forage in ASALs: Case of North Africa
Cactus has been used as all year round, dry season and/ or emergency forage in the drylands of Africa. In North Africa, cactus has a history of over 100 years where it is already an accepted animal feed resource and technology (see Tiedman, 2005) and it has been planted in large areas in Algeria, Morocco and Tunisia. In central and south Tunisia, opuntia plantations provide a large amount of fodder for livestock and play a key role in soil conservation. Together with shrubs, it has been planted on communal and private land and in both cases it has been combined with water and soil conservation techniques (thus providing additional benefits of ecosystem services support). The common planting technique used on private land is alley cropping and in communal land, rows without removing vegetation (Nezaoui and Salem, 2001). Part of the success is use of participatory community approaches in technology dissemination (Tiedman, 2005).

Fodder trees and shrubs constitute a major component of the diet of livestock in arid and semi-arid zones of Africa (Otsyina et al., undated). It has also been noted that the integration of fodder shrubs into the production systems in the dry areas of North Africa and Central and West Asia could reduce rangeland degradation and mitigate desertification (Larbi et al., 2006). The loss of indigenous perennials plants and shrubs in North Africa rangelands due increased population of people and livestock has therefore necessitated rehabilitation of denuded areas e.g. by reseeding the degraded areas with legumes. Research in the region has identified several legume species as suitable for reseeding degraded marginal lands: Trifolium angustifolium,

Cacti (especially Opuntia genus) have also been shown to be among the best options for fodder crop establishment. Besides, it is also useful in fighting desertification through soil conservation. It has been used in North Africa (widely used), East and Southern Africa. Cacti are recommended especially due to its high tolerance to drought and high water use efficiency, its ability to withstand severe defoliation and have good regeneration ability.

There are success stories of some African grasses that have revolutionized livestock production in Latin American and Australia. For example, Bracharia spp hybrids, whose origin is Africa have proved to be very productive and nutritious to livestock in Brazil, Argentina, Indonesia, and Australia. Bracharia spp hybrid (Mulato) can produce 25 tons/ha dry matter with a crude protein value ranging from 10.6- 13.1 per cent and maturity period of between 90 to 168 days. There are several other grass and legume species that are highly productive for fodder crop production that can be adopted as good practices in African rangelands if bottlenecks and barriers to community upscaling can be addressed.

Fodder development in ASALs face the challenge of high grazing pressure and hence the need for controlled grazing and/or adjusting livestock numbers (Øygard et al., 1999). Other challenges relate to the limited information on yield and quality of native and introduced fodder shrubs (Larbi et al., 2006) which calls for further research, and the availability of fodder seeds in the local markets which has been a bottleneck to promotion of fodder crops. Experiences from Argentina indicate a lack of secure land tenure and control of livestock movement as major constraints to establishing cacti plantations (Guevara and Estevez, 2001).

### 4.7 Integrating local and scientific knowledge

Indigenous people have a wide knowledge of the ecosystems in which they live and of ways of using natural resources sustainably. Most past investments in rangelands did not take adequate cognizance of traditional knowledge, also referred to as farmer knowledge or indigenous knowledge. Part of the reason for failure of past investments in rangeland development was because these investments changed traditional patterns of land use which in effect weakened indigenous pastoral production systems (Liniger et al., 2011). However, today there is more recognition of indigenous knowledge among researchers and development agents. A significant overlap in local and scientific knowledge base is noted when assessing land degradation in South Africa, which underscores the importance of both biophysical and human aspects in rehabilitation programmes (Olukoye and Kinyamario, 2009). Research and development project that employ a combination of local and scientific knowledge to improve management of the drylands have been implemented. However, the integration of new technologies with local knowledge requires careful assessment of their impacts, limitations of their application, and the possible damage they may cause (Nefzaoui et al., 2007).

Indigenous knowledge of pastoralists and agro-pastoralists in land management and conservation is an important entry point for partnership with local communities and hence vital in promoting participatory approaches in sustainable rangeland use. Studies conducted in Botswana revealed that by forming fruitful partnerships between communities, researchers and extensionists, it was possible to foster local innovation that could better guide attempts to enhance the capacity for communities to reduce degradation or adapt their livelihoods to land degradation threats (Reed et al., 2007).

In most cases, pastoralists are viewed by researchers and policy makers as agents of land degradation, but over time a rise in participatory research started to recognize local pastoral knowledge. This is well encapsulated in Principle 10 of the Rio Declaration (1992), and the UNCCD (1994) both of which emphasize the need for stakeholder participation/local participation in environmental management (Reed et al., 2007), and more importantly in combating desertification. According to a study by Miehe et al. (2010), moderate grazing regimes imitating traditional nomadic systems are more likely to improve pasture quality and stability, though this will require decades of careful management.

Use of indigenous knowledge in both research and development gives it legitimacy and credibility among local people (Langill, 1999) and hence approaches that strengthen indigenous knowledge and institutions contribute to local capacity building which is vital for sustainability of development programmes. The integration of scientific knowledge and traditional (farmer) knowledge has been successfully employed by ICARDA in Morocco and scaled out to Algeria, Libya, Mauritania, and Tunisia to promote range management practices (Tiedman, 2005). Despite its usefulness, indigenous knowledge has its limitations and challenges including the fact that empowerment of previously
marginalized groups may have unexpected and potentially negative interactions with existing power structures (Reed et al., 2007). In addition, there is possible erosion by wider social and economic forces sweeping across the entire world. Interventions that promote preservation (e.g. documentation) and propagation of traditional knowledge and management systems are therefore, considered a good practice as they help restore traditional coping mechanisms.

4.8 Water harvesting and conservation technologies
Drylands are areas with limited water (and moisture) resources and hence management of water resources poses a major challenge in promoting sustainable utilization of the drylands. Good water resources management in dryland is paramount in order to sustain the productive capacity of the land and to better cope with water scarcity and the extremes of droughts and floods. The key to sustaining productivity of uplands and downstream areas is to manage land and water resources in concert with one another (Kenneth and M’Hammed, undated). Rainwater harvesting techniques can also be used to help restore diversity to rangelands impoverished by drought and overuse, and when combined with pasture plants can improve grazing for livestock (ICARDA, 2008). Several techniques can be used for rainwater harvesting which include collection and concentration of rainfall run-off in micro-catchments, cut-off drains, sand dams, ponds (see Figure 8) and rock catchments.

The management and conservation of dryland wetlands/watersheds is also critical in maintaining the productivity of rangelands. Dryland watershed management encompass measures for prevention of land degradation along riparian areas, rehabilitating degraded watersheds and through compensation mechanisms for upstream (watershed) communities who undertake land improving activities and promote compatible land uses. World Overview of Conservation Approaches and Technologies (WOCAT) has a database of successful soil and water conservation approaches and techniques into land use systems world-wide.

4.9 Promotion of dryland products (production and marketing)
Dryland communities largely depend on natural resources for their livelihoods. Sustainable livelihoods in the drylands need to take cognizance of the alternatives available for livelihood diversification that is vital for enhancement of food security and household incomes among other benefits. Studies, have established that there is great potential for the production of dryland products. However, institutional capacity is often poor, and the policy and legal framework unfavourable to progress in production and marketing of dryland products. Improved production and access to markets for dryland products coupled with sustainable management of natural resources would therefore greatly contribute to alternative livelihoods of dryland communities.

Among the key potential dryland products are animal based (skins, wool and milk among others), plant based genetic resources (e.g. Aloe vera, frankincense, myrrh, gum arabica, and medicinal herbs), honey, handicrafts and minerals all of which have a ready market locally and abroad. For example, there is a high international demand for gum arabica and Aloe vera. In Sudan, gum arabica is a major item of export. Besides relying on the biological resources, dryland physical landscapes can be packaged as nature ‘products’ for their unique aesthetic value, which can support recreational income generating enterprises that have minimal negative environmental impact.

Private sector participation through partnership with local communities has been found to be an important ingredient in successful trade/marketing of dryland products. For example, it was observed in Ethiopia that bio-enterprises established and developed by or with the private sector have been sustained. However those set up and developed purely by NGO community projects did not progress despite the initial level of investment, except where there was involvement of a ‘champion’ or active CBOs (Wren and Mamo, 2009). Private sector players would be expected to bring expertise, experience and resources/capital necessary for trade promotion in dryland products. However, synergy between communities and private sector requires a facilitative policy environment, locally and globally. Other challenges to promotion of dryland
products in drylands include: poor marketing, availability of cheap technologies for processing dryland products, and poor (technical and business skills) capacity among communities.

4.10 Participatory and community-based approaches to Natural resource management

Participation comprises a key ingredient of the sustainable development agenda. Participation facilitates accurate understanding of problems and their nature leading to collective action (Holmes-Watts and Watts, 2008) that is better informed. Active participation of pastoralists and agro-pastoralists is essential in sustaining rangeland management and improvement. There is increasing interest in community-based approaches to the management of natural resources in Africa (Fortmann et al., 2001 and Guyo et al., 2003). There are several benefits of community participation which include increased efficiency by utilizing local resources and skills, enhanced effectiveness and sustainability of activities as they are based on local knowledge and understanding of problems (Holmes-Watts and Watts, 2008). As has been observed in ICARDA’s range rehabilitation projects in North Africa, the active participation of pastoralists (resource users) is essential in sustaining rangeland management and improvement (ICARDA, 2010). Community participation in NRM can also be realized through learning and knowledge sharing mechanisms. Pastoralist knowledge and innovation can be enhanced through participatory learning and participatory technology development approaches. The Pastoralist Field Schools (PFS) are one of the appropriate approaches used for participatory learning and implementation of initiatives like drought management among pastoralists. To be sustainable, participatory learning approaches need to be complemented with capacity strengthening, value chain development and organizational change.

It is acknowledged that pastoralists are the custodians of the rangelands and participatory approaches involving them, scientists and policy makers have been implemented with success. ICARDA has successfully used participatory and community-based approaches to improve rangeland management and seeks to out-scale the success to more countries. For the community-based approach to be successful it must be demand-driven, socially acceptable and one that creates an enabling policy and institutional environment (Nefzaoui et al., 2007). In addition, the inclusion of the poor requires very careful project planning and design.

4.11 Transboundary and ecosystem/Landscape approach to NRM

Ecosystems represent the functional space and interactions of living and non-living elements of the environment and hence the need for resource management that is ecosystem-based. The ecosystem approach to NRM entails integrated management of land, water and living resources in a way that promotes conservation and sustainable use, and recognizes the importance of involving all stakeholders in decision making (CBD, 2010). Drylands ecosystems span across local and national political boundaries necessitating sharing of resources and ecosystem services. Key among the shared resources are forests, wildlife, grazing lands and water catchments, which calls for resource management approach that is more transnational/crossborder. In addition, crossborder communities have seamless cultural interactions, and activities in one country or jurisdiction can significantly affect environmental and social systems in the other/neighbour (InWEnt and GTZ, 2005). Transboundary natural resources management (TBNRM) is therefore important not only in promoting sustainable natural resource management but also for stronger sub-/regional integration and cohesion. The adoption of ecosystem management approaches is supported by empowering communities, sharing knowledge and stakeholder partnerships on a large scale (Mortimore, 2009). Practices that maintain the interconnectedness and inter-dependence of ecosystems and communities should therefore be promoted and supported TBNRM calls for the harmonization of policies across national borders and collaboration in the management of shared ecosystems, coordination and dialogue to foster institutional collaboration from local to regional levels, and also ensuring socio-economic benefits for all groups of people (InWEnt and GTZ, 2005). It improves regional ecological management, increases economic opportunities, decreases cultural isolation, fosters peace, and provides a basis for further collaboration (WWF, 1999). Successful TBNRM therefore requires incorporation of peace building, trade facilitation and infrastructure development, among other requirements. Transboundary collaboration is thus becoming increasingly
Box 7. Case Study: Karamoja cluster peace and development project

The Karamoja Cluster for Peace and Development (KCNP) project was implemented by Practical Action (UK) in Kenya, Uganda, Ethiopia and South Sudan through a networked approach meant to harmonize and improve coordination of peace and development initiatives in the Karamoja pastoral ecosystem. The Karamoja area has been characterized by systemic conflicts arising from cattle rustling and competition for grazing resources across national borders. The major beneficiary pastoral communities were Karamojong of Uganda, Turkana of Kenya, Toposa and Nyangatom of South Sudan, and Merille of Ethiopia. KCNP worked through a network of development partners and community-based organizations spread across the region to undertake development and peace work. The outcome led to better sharing of resources, enhanced community capacity for peace building and conflict resolution and increased crossborder trade particularly among the Turkana and Karamojong. The proposed Transborder Development Basin and recent proposal for a regional pastoral policy for East Africa are likely to contribute significantly to the sustainability of the KCNP intervention.

Important as evidenced by the increased number of transboundary protected areas (TPAs) throughout Africa, for example in the Great Lakes Region and the emergence of proposed Transborder Development Basins in the IGAD region. Further, the emergence of policy and institutional frameworks that promote TBNRM is creating a conducive environment for sustainable TBNRM.

A recent example of TBNRM is the Serengeti-Maasai Mara Ecosystem (SMME) Dialogue jointly promoted by InWEnt and GTZ (Tanzania), which seeks to establish a regional initiative on the conservation and management of the SMME for biodiversity conservation, socio-economic development and peace building and cooperation (InWEnt and the GTZ, 2005). Through its African Heartlands Program, the African Wildlife Foundation (AWF) promotes transborder wildlife conservation, where the underlying concept is landscape level planning for high biodiversity value landscapes across Africa, including rangeland savannas.

The interventions of AWF Heartland Program are designed to halt or reverse the process of landscape fragmentation in large conservation landscapes (Henson et al., 2009). Land fragmentation is one of the threats facing both wildlife conservation and pastoral mobility. Other extensive transborder ecosystems in Africa where TBNRM is relevant include: West-Arly-Pendjari Ecosystem (Burkina Faso, Niger, Benin); Karamoja Ecosystem (Uganda, Kenya, Ethiopia and Sudan), and the Somali Ecosystem (Somalia, Ethiopia, Djibouti, and Kenya). Successful TBNRM has to overcome the challenges related to policy difference across nations, lack of political will, different levels of management capacity among neighbouring states and community perceptions.

4.12 Payment for Environment Services (PES)

Market-based instruments for capturing the financial value of ecosystem services can be an important tool for improving livelihoods and attracting capital to poor communities in developing countries (UNDP http://www.undp.org/drylands/pay-environment-services.html). Payments for Environmental Services (PES) is an innovative market-based mechanism based on the twin principles that those who benefit from environmental services should pay for their provision, and that those who provide environmental services should be compensated.

The objective of PES programs is to address environmental and NRM problems, by providing a mechanism to internalize externalities (Pagiola, 2007). PES has therefore emerged as a policy solution for realigning the private and social benefits that result from decisions related to the environment (Jack et al., 2008). PES holds good potential for ecosystem and landscape-based management approaches especially for dryland watershed management, wildlife conservation (ecotourism) and carbon sequestration.

Figure 10. Scenic beauty in the drylands
The drylands provide various ecosystem services and products whose value in most cases has been under-estimated. There is generally a lack of knowledge and appreciation of the true value of dryland ecosystem services. Likewise, there is inadequate recognition of the dryland ecosystem in national accounts, which has led to neglect in economic planning and service provision (Mortimore, 2009). Communities need to be enlightened on the nature of ecosystem services provided by drylands and their interconnectedness for them also to understand the impact of land use practices on the provision of various ecosystem services.

Box 8. Reto-o-Reto project: Pastoral livelihoods and wildlife conservation - securing wildlife migration corridors

Both the pastoralist life and ecosystem in the Athi-Kaputiei plains are under threat from changing land use and tenure, particularly with the expansion of Nairobi City. These changes severely threaten the livelihood of local Maasai who have inhabited the region for hundreds of years. The changes have also caused major losses of wildlife with about 70% loss in wildlife in the last 25 years in Kitengela area. Recognizing the value of this ecosystem, and through the efforts of several stakeholders, a Wildlife Conservation Lease Programme (WCLP) was launched in 2000, with the key aim being to encourage the pastoralist to keep land open for livestock and wildlife but still retain ownership. The programme aimed to lease and conserve 60,000 acres to allow the seasonal migration of wildlife to and from Nairobi National Park. For the foregone economic opportunities of fencing, selling, or farming their holdings, the programme paid landowners US$4 per acre per year. On the conservation front, the programme succeeded in securing more grazing areas for livestock and wildlife dispersal, and reduced human-wildlife conflict. From a socio-economic point of view, the Programme increased support to livestock husbandry, boosted household incomes and importantly, managed to change community attitude towards wildlife conservation (Reto-O-Reto Policy Brief 1, http://www.reto-o-reto.org/downloads)


PES projects have been implemented in several parts of the world, in Europe, America, Asia and Africa. However, payments for environmental services are relatively young instruments (Mayrand and Paquin, 2004) but there are indications of potential success gauging from current state of the literature on PES schemes. UNDP – Drylands Development Centre DDC is working closely with ICRAF, UNEP and NGOs and Sub-regional Organizations to promote payment for environmental services in the arid and semi-arid regions of the world. It has been suggested that PES should be supported by systematic and ongoing policy.

4.13 Wildlife-livestock-human interaction management

Wildlife and livestock co-exist in some of the Africa rangelands, particularly outside protected areas (e.g. national parks) and the management of their interaction provides a key challenge to NRM managers and affected communities. As acknowledged earlier in Section 3.3, there is a growing recognition that harmonious co-existence between wildlife and livestock is possible and the integration of livestock production and wildlife is already taking place among some pastoral communities. The AU-IBAR through its pilot project DLWEIP demonstrated this possibility and the outcomes indicate the sustainability of the wildlife-livestock shared ecosystems where the management approach is integrated to simultaneously cater for wildlife and livestock (AU-IBAR and UNEP, 2009). In addition the relationship between wildlife and livestock is known to be mutualistic. The management of both wildlife and livestock present great potential for livelihoods particularly due to expected economic returns from tourism in case of wildlife and livestock marketing.

The community conservancy approach is recommended as one of the best practices in managing rangelands used jointly by wildlife and livestock due to...
its multiple contribution, in terms of rangeland conservation, livestock and wildlife management, and opportunities for diversification of livelihoods for instance through ecotourism. In this approach, communities set aside land for conservation, grazing and settlement within a single land use plan. A classic example is of the community conservancies found in northern Kenya.

However, the sustainability of this practice is pegged on the policy environment, institutional capacity of communities, and equitable benefit sharing among other factors. The conservancy approach involves participatory land use planning where the community is the key player. It also entails setting up mechanisms for conflict resolution; benefit sharing, compensation and resource governance and building management capacity of the community, all of which are key ingredients of sustainability of this NRM system.

Wildlife conservation is a viable land use option in some of the ASALs. The conservancy approach therefore, provides a good strategy for the re-introduction of wildlife in areas that were previously rich in wildlife but have lost a great deal of the wildlife due to loss of habitat arising from anthropogenic forces.

CHAPTER 5: LESSONS LEARNT AND EXPERIENCES IN PROMOTING RATIONAL USE OF RANGELANDS IN AFRICA

Various efforts to promote rational use of rangelands in Africa have brought forth several lessons, both in terms of success and failure. However, most of these lessons remain with project implementers and/or stakeholders, and have not been documented for dissemination to a wider audience to enhance learning and information sharing. The succeeding section outlines some key lessons identified from various interventions in drylands management in Africa and beyond.

5.1 Institutional and political lessons

i. Community empowerment and involvement is crucial for effective and sustainable range management, particularly in long-term initiatives such as land improvements which require long-term commitment and participation of the community. The responsibility for change must be in the hands of the communities and households who derive their livelihood from the resource. Community-based approaches are also important as most of the land in rangelands areas is pastoral and communally owned and individuals may not have incentives to invest in SLM.

ii. Government support and commitment is critical in rangeland and pastoral development. However, experience indicates that the state should play a lesser role in organization and implementation of range management projects than the beneficiaries, which helps to empower communities and increase ownership of SLM interventions.

iii. The involvement of grassroot organizations (both NGOs and CBOs) for transfer of technologies and dissemination of financial resources to local communities has good potential for SLM promotion and adoption. However, it is prudent to undertake vetting of these institutions through capacity assessment using comprehensive criteria to ensure they are competent.

iv. NRM for peace - promotion of transboundary management for shared resources provides a good basis for cross border dialogue by establishing transboundary collaboration. Such cooperation is a highly valuable ingredient in the promotion of regional economic and political integration process that is on-going in Africa (AU-IBAR and UNEP, 2009).

v. Effective action in fighting land degradation in drylands requires cooperation and partnership at all levels (local, national and international) in order to mobilize adequate resources and technical support required to
achieve long-term local and global benefits.

vi. Successful local-level management of natural resources requires investment in community-level capacity building and empowerment in the areas of organization, financial management and NRM. Experience shows that this usually requires more time than is provided by most projects.

vii. In Transboundary Natural Resources Management (TBNRM), political support from the concerned countries is imperative if interstate organizations are to achieve the goals set at their creation and hence TBNRM needs to be perceived as the best way of achieving what is considered national goal. Lack of (political) support from member states limits the achievement of the goals of TBNRM, initiatives (Lycklama à Nijeholt, 2001).

5.2 Technological and knowledge issues

i. Successful grazing management through destocking is only possible under favourable climatic and ecological conditions and requires elaborate logistical and technical support. It also requires incorporation of drought contingency plans (e.g. mobility and access to other productive areas) to cushion herders from high (livestock) losses occasioned by drought-related circumstances. Otherwise, herders have no option but to sell their animals at very low prices (below market prices) only for them to buy food at very high prices. This severely undermines their resilience to drought.

ii. Building on indigenous knowledge and practices is an important strategy. Land-use technologies founded on local practices and knowledge have a more positive impact on the environment than standardized high-input technologies. Moreover, they have a greater chance of success since they match resource priorities of users and available resources better and hence tend to have much higher adoption rates.

iii. The economic values of drylands can only be enhanced with a clear understanding of their particular ecological, social and institutional characteristics (UNDP, 2008).

iv. Water development in drylands should be carefully done, by integrating it with some range conservation and management system particularly grazing patterns and control of stock movement. In the absence of a good range lands conservation and management system, water interventions can lead to overstocking and consequent overgrazing around water points leading to range deterioration.

v. Studies suggest that it is important for managers to identify and monitor the boundary between equilibrium and non-equilibrium land use systems in order to develop appropriate rangeland management policies and interventions (Tomoo et al., 2011).

vi. Interventions should adopt, in the design and implementation stages, more flexible approaches that are responsive to modifications required to address the changing problems, priorities and resource situations of the herders; This implies flexibility in the choice of management options.

vii. Interaction between pastoral systems and agricultural systems is not likely to be favored by integration of livestock within agricultural systems and agricultural intensification. Part of the reason is that whereas certain groups of resource users can benefit from integration, others like the transhumant pastoralists are likely to be much worse off as they will lose options for access to resources and benefits from interaction (Øygard et al., 1999).

viii. Promotion of effective learning and exchange of information and experiences on good practices is an important strategy in promoting uptake of best practices - multi-level (local, national and international) e.g. pastoralist to pastoralist information exchange.

ix. Rangeland communities are aware of the declining state of resources occasioned by land use changes/conversion and increasing land degradation, and are already adapting albeit in ways that may not be environmentally sustainable. This understanding forms the basis for their active involvement in range rehabilitation and improvement activities as they have first-hand information and understanding of the context in which they live. Thus project interventions need to be consistent with local strategies and responsive to local priorities.

x. Development is closely linked to education, which ranks high on community priority lists and provides important exit strategies for pastoralists/farmers. Education of farmers/pastoralists should therefore be supported. Some countries have introduced mobile schools for pastoralists, which have been tried and proved effective in some areas. In addition, the integration of proven good practices and technologies learnt from field into higher education curriculum would go a long way in equipping graduates.

5.3 Ecological, economic and social lessons

i. Community-based range rehabilitation with strong participation of women in project activities can be instrumental in building the resilience of dryland communities and sustainability of interventions. Although women are key resource users, in many instances they have been sidelined and their participation in management of natural resources is minimal particularly due to socio-cultural inhibitions.

ii. Rural communities usually cause damage to the environment out of
basic necessity rather than ignorance. It is therefore important to balance economic and environmental benefits when promoting conservation and range restoration/rehabilitation measures. Experience shows that community members get motivated to participate in range conservation if there are some tangible benefits accruing to them, at least in the short term.

iii. Projects that target the poorest require careful design of project activities, so as to secure their participation and ensure benefits flow. It has been observed that local associations tend to be dominated by the richer members of the community and financial institutions hesitate to provide credit where they see a greater risk of default. This can further promote inequality rather than equity.

iv. Though active participation of communities is essential in sustaining rangeland management and improvement activities, participation is rarely well implemented in most projects. Active participation in decision making, planning and implementation is rarely achieved even where it is in the project design.

v. Governmental subsidies have been part of the success of range rehabilitation projects where heavy investments were required. However, they were also cited as a cause of failure of the ambitious pastoral cooperative programme of the 1980s in Algeria—government subsidies in crisis management during and after drought (e.g. for restocking) mainly favours the large herders and contributes to degradation due to overgrazing. Government subsidies should therefore be used carefully and scarcely.

vi. The adoption of rangeland rehabilitation technologies requires financial support. Communities alone cannot bear the cost of re-vegetation, and hence there is need for seed capital to stimulate adoption. Experience from successful range restoration in North Africa and Asia (e.g. China) indicates that projects had to be supported with subsidies and strong commitment from government.

vii. Projects/technologies that enhance income generation for the local people record high rates of adoption. For instance, adoption of agroforestry is most likely where it is consistent with economic incentives for land use change. In addition, it is important to balance economic and environmental benefits.

viii. Conflict management is essential for sustainable development particularly in areas prone to resource-based conflicts like pastoral systems and forest areas. There is therefore need to strengthen community-based and other conflict management systems to ensure sustainability and adoption of best land management practices.

ix. TBNRM experiences from West Africa indicate that local-level and small-scale NRM initiatives result in more concrete changes than high-level or economic and environmental benefits when promoting conservation large-scale projects (Lycklama à Nijeholt, 2001).

5.4 Policy, governance and legal factors

i. Land tenure remains a major challenge to the implementation of large-scale range management interventions (e.g. rotational grazing), especially because of the multiple user nature in the pastoral land. Therefore successful introduction of such interventions require good understanding of the circumstances influencing access to rangelands and the complex grazing patterns.

ii. The sustainability of dryland ecosystems and pastoral development ultimately depends on flexible and mobile transhumance systems and on access to key resources (Øygard et al., 1999). Policy and planning for these ecosystems should therefore support mobility.

iii. Mobility (either trans-humance or nomadic) is a necessary ingredient of pastoral production systems. The success of maintaining mobility routes depends to a large degree on the establishment of a functioning space for intercommunity consultation and continuous dialogue. This is important due to the increasing pressure on land, grazing and other natural resources which tends to increase stress on the relationship between various resources users such as farmers, herders, conversationists etc.

iv. The changing types of land-use and tenure systems still pose a major challenge to rational rangeland management. It is noted that interventions to be undertaken need full recognition and harmony with traditional practices, customary laws and ethnic diversities which have a bearing on resource use and ownership.

v. Policies and strategies aimed at reducing the vulnerability of dryland communities should be mainstreamed within the broader development agenda whose focus should be to increase their resilience to environmental and economic shocks they encounter rather than helping them overcome single events like drought.

vi. The process of democratization in Africa mainly centered on decentralization and less state engagement may be an opportunity rather than constraint in the development of sustainable local initiatives to fight environmental degradation in the drylands. However, such initiatives should be supported by organizations specializing in community development (UNEP, 2002a).

vii. The adoption of new technologies in marginal lands is often low because of the variability of returns to farmers/pastoralists and institutional
constraints such as land tenure. Subsidies are therefore necessary to promote technology adoption (CGIAR, 2005).

Management of transborder natural resources tend to be most successful where national governments have devolved some aspect of control over land and resource use to local groups (WWF, 1999). This implies the need for recognition and harmonization of regional property regimes.

The following are among the key barriers and bottlenecks to sustainable management of drylands in Africa:

i. Maintaining adequate access to land and water: Increased population pressure, including in the arid and semi-arid lands is leading to increased encroachment of crop farming into the higher potential areas of the arid lands that serve as dry-season grazing areas. Competition over resources (water, pasture) undermines pastoralists risk management strategies and is a basis for conflict between pastoralists and sedentary agriculturalists. This coupled with widespread degradation in drylands presents a difficult situation.

ii. Incidences of prolonged drought with multiple effects particularly scarcity of fodder and water, food insecurity, livestock losses, and climate induced land degradation can greatly reverse gains made for example in range rehabilitation/restoration where full recovery has not yet been realized.

iii. Slow reform process: Insecurity of land tenure has been identified as one of the main challenges to the introduction and adoption of SLM (e.g. in Uganda, policies dealing with land tenure and property right issues in drylands have been taking long to develop). The speed of policy response to these challenges is far behind the rate of change (some of it irreversible) already taking place in the drylands. Policies and governments are not responding fast enough or adequately to match the dynamism and rate of change being witnessed in drylands. The sustainability of rangelands...
requires constant adaptation to change.

iv. Weak policy support stemming from systemic bias and lack of clear understanding of the drylands, as evidenced by undervaluation of resources and services. In effect, government policies have failed to effectively protect key pastoral resources, such as wetlands, dry season grazing reserves and livestock corridors, from encroachment by farmers, investors and national parks. Mobility is misunderstood by policy makers and development practitioners and hence implementation of legislation relating to livestock mobility in pastoral systems may not receive due attention among government officials. Policies therefore need to adequately address the issue of tenure for communal rangeland resources and keeping in check cropland encroachment in best grazing areas.

v. The development of multinational policies and agreements for management of transborder resources may be hindered by issues related to national sovereignty and security and the high transaction costs involved (WWF, 1999), thus slowing down efforts for creating an enabling environment for uptake of good practices in TBNRM. In addition, differences in capacity, commitment, and national policy across borders are strong constraints to development of transboundary agreements (WWF, 1999) that would be required for crossborder resource management (TBNRM). For example whilst Tanzania allows game hunting, Kenya does not. In addition, there is lack of capacity (human and financial) among various institutions such as governments.

vi. Lack of knowledge: Although integration of fodder in dryland production systems is considered important in reducing rangeland degradation and mitigation of desertification, there is lack of sufficient information especially on the yield and quality of native and introduced fodder shrubs. Regarding dryland products, there is a widespread lack of knowledge on the usefulness of dryland products. Information sharing on best practices across a broad range of stakeholders is also limited.

vii. Poor physical infrastructure: Drylands still suffer from underdevelopment due to lack of basic infrastructure such as roads and functional markets. This has been informed by the misconception that public investment in drylands does not pay. Promotion of alternative livelihoods such as livestock trade, ecotourism and dryland products require the support of a reliable transport and communication network.

viii. Globalization trends (e.g. modernization) that undermine the traditional, socio-cultural foundation upon which pastoral communities have built their survival for many years. Pastoral communities are not functionally well prepared for the inevitable changes in the global socio-economic and political scene.

ix. Incongruence between national and regional NRM policies is a major bottleneck to sustainable crossborder/transboundary NRM. Some drylands face geopolitical instability which obligates policy makers to make linkages between security and ecology (Mortimore, 2009). The situation is aggravated by political upheavals particularly in the Horn of Africa (Somalia and Southern Sudan among others) and some West African countries.

x. Poor or lack of information sharing and dissemination due to institutional weaknesses: Often, there is lack of formal and sustainable communication pathways among various development institutions/ players which restricts exchange of information, technologies and lessons learnt. This adversely curtails adoption and replication of good practices in range management.

xi. Promotion of alternative livelihoods and income generation: This requires high level of investment (infrastructure, marketing, capacity building). Currently there is underinvestment which undermines efforts to realize sustainable rangeland development and support sustainable livelihoods.

xii. Limited institutional capacity: sustainability of good NRM practices requires that there is collective action particularly at community level which is not easy to achieve and maintain. There is need for motivation (to ensure societal cohesiveness) and policy support e.g. strengthening community NRM bylaws through gazetting.
CHAPTER 7: OPTIONS FOR THE FUTURE:
RECOMMENDATIONS AND WAY FORWARD

Despite the seemingly overwhelming challenges related to drylands management, opportunities exist for sustainable utilization and management of dryland resources and ecosystems, and to enhance livelihoods not only in the context of dryland communities but also contribute to national and global economies. Better understanding and knowledge of the drylands is required to dispel misconceptions and tap into opportunities based on land productivity and those not based on land productivity (or alternative livelihoods). It is also necessary to develop tools and undertake valuation of dryland goods and services in order to enhance their importance in the mainstream economic planning and development. Creation of linkages between drylands and national and global economies can also be realized through enhanced access to markets by addressing market barriers.

Among the key challenges to dryland management is the question of security of tenure, both in terms of property ownership and resource access and hence the need for securing rights, for example through protection of pastoralism in the constitution and enhanced community governance of natural resources. As part of long-term measures, efforts to enhance the ability of dryland communities to cope with changes particularly those related to climate are paramount in order to reduce vulnerability to shocks and risks, and increase their resilience capacity. Therefore, governments and development partners need to shift from relief and humanitarian interventions meant for emergency responses to more long-term investment in sustainable dryland production and management. Ultimately, the adoption of best practices will hinge on creating an enabling policy, institutional, and economic environment including infrastructure development as well as building the capacity of communities and nations to scale up best SLM practices.

7.1 Opportunities for drylands development in Africa

The importance of drylands cannot be overemphasized. However, solutions for desertification and sustainable development in drylands are not simple but would require an appreciation of the full complexity and dynamics of dryland ecosystems; recognition of their full potential for development; taking account of the changing world conditions; and restoring the initiative to dryland peoples themselves (Mortimore, 2009). Existing economic and non-economic land productivity-based and non-land productivity based opportunities in the drylands include:
• Expansion of trade options, for example through ecotourism, promotion of dryland products and enhancing marketing linkages and partnership with private sector offers good trade potential if foundational trade constraint are addressed at local, national and international levels.
• Integration of markets and increasing regional interconnectivity - The process of regional integration, for instance the revival of the East Africa Community (EAC) will help provide the regional organizational framework within which NRM initiatives can operate, particularly with reference to trans-boundary resources.
• High and growing demand for animal protein all over the world - It is projected that annual meat demand per capita in Africa will double by 2050. Pastoralists could help to close this gap if supportive policies are put in place (ODI, 2009a). The pastoral livestock production system, being the most common land use in Africa drylands, has the potential to meet a significant part of this demand. This is also an opportunity for the reduction of poverty among poor households whose livelihoods are livestock based.
• Drylands are endowed with rich biodiversity pool whose potential remains untapped. The biological diversity of drylands is of particular importance because it includes many unique biomes. The Drylands offer great potential for tourism, ecotourism, cultural tourism associated with wildlife habitats, historical and religious sites.
• Alternative energy development - drylands are endowed with vast solar and wind potential to generate energy that is under-exploited. Incentives (policy and economic) are required to attract the private sector investment in energy development in the drylands. A good example is the Lake Turkana Wind Power project that will be completed in 2012 and will be providing 300 MW or 17 per cent of clean power to Kenya’s national electricity grid.
• Global funding mechanisms - African countries can tap into global resources to undertake community level NRM activities that not only enhance rangeland productivity but contribute to global benefits such as carbon sequestration and climate regulation. Already in some African countries the private sector is promoting the Clean Development Mechanism approach by supporting community environmental conservation.
• Pan African pastoral policy - lack of a regional pastoralism policy framework has been one of the constraints in promoting good practices in range in Africa. The current efforts to establish a policy instrument presents a good opportunity to enshrine pastoralism as a rational production system within regional and sub regional development documents. The policy will be expected to create impetus for financial, institutional and political support for pastoral programmes that enhance economic, social and environmental wellbeing of dryland ecosystems and societies.

7.2 Way forward- actionable recommendations
Following are the proposed specific action areas for the promotion of best practices and lessons learnt identified for sustainable rangeland management and fodder crop development in Africa.
• Incorporate climate change adaptation measures in drylands development programming. It is projected that drylands will be more affected by climate change, with devastating effects like flooding, livestock losses and famine as currently being witnessed in the Horn of Africa. Enhancing food security and household incomes is key as this will ensure communities do not resort to unsustainable exploitation of resources to cope with extreme climate events, and abandon good practices that may not have direct benefit at such times. It is evident that the cost of humanitarian and relief responses far exceeds the cost of investing in adaptation and hence the need to invest in long-term and sustainable solutions.
• Animal feed resources - fodder crop and pasture management are critical for livestock production which is the main economic activity in the drylands. Seed multiplication for suitable fodder species through pastoralist/farmer-led arrangements coupled with access to finance is necessary in promoting fodder production and preservation technologies.
• The capacity of communities to undertake resource augmenting activities in the predominantly common resource and insecure tenure rangelands is undermined by poorly defined resource tenure and ownership. Countries are required to come up with specific policy, legal mechanisms and incentives to promote range protection and improvements at community level. There is need for land tenure reforms and harmonization of national legislation and policies to stem fragmentation and duplication of authority and responsibility among various government ministries and institutions dealing with land.
• Conflicts, insecurity and war are among key challenges in the African drylands. Although most development agencies acknowledge this and some have attempted to mainstream peacemaking and conflict resolution in their programmes (humanitarian or development), much needs to be done to ensure peace making and conflict resolution core programs especially because of the systemic nature of conflicts in most drylands
where mobility is needed. It is particularly important to promote negotiation skills, dialogue and mutualistic arrangements that do not undermine the natural resource base.

- Strategic engagement of the private sector, particularly through private sector-community and private sector-state partnerships in promoting best practices for range management and utilization, for example through establishment of community-based conservation trust funds that are driven by the private sector. This will require innovativeness and a facilitative business environment. Already some companies through their corporate responsibility agenda are supporting environmental rehabilitation programmes.

- Enhance research and information sharing at the grassroots level. The establishment of community resource centres can be explored especially for building community capacity to effectively handle development and conservation matters. This will also help address the researcher and policy maker-pastoralist gap by enhancing interactions between the community and professionals. Active community participation is key in sustaining good practices.

- Comprehensive land use planning and zoning at landscape and ecosystem levels to respond to the challenges of encroachment of grazing resource areas, population growth and urbanization challenges. Inevitably, policy support and capacity building of communities and governments is required for developing and implementing such plans. This is necessary because of the multiple uses and nature of rangelands, and the competing and emerging uses that appear inevitable and which unless they are well regulated will undermine the resilience of rangelands.

- Participatory learning and technology development through pastoralist-pastoralist and farmer-farmer extension or exchanges should be upscaled. It is a proven fact that communities learn from one another more easily compared with formal professional-pastoralist/farmer set-ups. After all it is the ‘shoe wearer who knows where it pinches most’. This will help to fast track dissemination of good practices as most of them still remain at pilot stage and some are only confined within project sites. In addition, witnessing successes among communities living in similar ecological contexts will motivate them to adopt good practices.

- Multiple and integrated water solutions: Water resource management strategy should consider the whole range of options that would avoid concentration of populations of settlements and livestock around permanent water sources. For example, there is need to introduce water harvesting technologies to meet domestic water needs, seasonal water ponds for mobile grazing, sand dams for water reserves during dry season, rock catchment for water storage and only develop large water sources for planned settlements.

- Wildlife-livestock interface management approaches which has already been championed by AU-IBAR through the DLWEIP project. Improvements in livestock production systems, health and marketing in pastoral society, along with sustainable exploitation of wildlife resources, are likely to lead to healthier ecosystems. Parallel to the improved understanding of the role of livestock in drylands, there is an increasing awareness of a new potential value of the wildlife resource through community based ecotourism and other forms of utilization, with wildlife industries becoming increasingly important in the economics of African countries (Chardonnet et al., 2002)

- Range rehabilitation and restoration initiatives: The communities are now willing to invest effort and resources in rangeland rehabilitation for fodder production and conservation. The practice can be upscaled especially in communal grazing where degradation is common.

- Invest in strengthening institutions and governance structures at local, regional and national levels to address the weakening of traditional norms and structures and lack of clear resource tenure structures in pastoral communal areas.
### ANNEXES

**Annex 1. Summary of experiences from key stakeholders in rangelands management in Africa**

<table>
<thead>
<tr>
<th>Drylands management issue</th>
<th>Stakeholders’ responses</th>
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</table>
| Challenges in promoting/adoption of SLM in drylands/constraints | • The challenge for proponents is to demonstrate to policy makers and funding agencies, through careful and control science-led projects that rangelands can act as growth points of the ASALs.  
• Lack of funds/lack of access to credit  
• Lack of knowledge and skills  
• Lack of education and training, especially for womenfolk  
• Poor infrastructure and amenities making them unattractive to scholars and developers  
• Maintaining collective action and sustainable NRM, beyond project life  
• Poor incentive mechanisms to invest in rangeland management  
• Low capacity of local institutions and weak capacity of partners from national research organizations  
• Cultural constraints (difficulties to accept change)  
• Difficult access to improved seeds and breeds  
• Difficult access to markets  
• Very high risks in production/survival  
• Lack of implementation of appropriate government policies  
• Lack of incentives for environmental stewardship where focusing on productivity alone would be environmentally threatening |
<table>
<thead>
<tr>
<th>Drylands management issue</th>
<th>Stakeholders’ responses</th>
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<tbody>
<tr>
<td>• ASAL people have tended to be less powerful politically until very recently in Kenya</td>
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<tr>
<td>• Traditional practices such as livestock rustling have promoted insecurity that makes them unattractive to developers</td>
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<tr>
<td>• Prolonged droughts and increase in human wildlife conflict e.g. increase in livestock depredation</td>
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<td>• Limited participation of women in community decision-making processes</td>
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<td>• Inappropriate national Policy and Sectoral policies</td>
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<tr>
<td>• Lack of appropriate and effective land resource tenure</td>
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<tr>
<td>• Climatic Fluctuation and Climate Change</td>
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<tr>
<td>• Shortage of stock water and pasture in dry season</td>
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**Best practices being promoted**

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<thead>
<tr>
<th>Drylands management issue</th>
<th>Stakeholders’ responses</th>
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<tbody>
<tr>
<td>• Integrated Natural Resources Management</td>
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<tr>
<td>• Dryland forestry and agroforestry</td>
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<tr>
<td>• Beekeeping</td>
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<td>• Fodder production and conservation</td>
<td></td>
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<tr>
<td>• Improved livestock/animal production</td>
<td></td>
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<tr>
<td>• Rehabilitating degraded lands through area enclosure and soil water conservation practices</td>
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<tr>
<td>• Integrating fodder trees and grasses for animal feed</td>
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<tr>
<td>• Payments for wildlife conservation</td>
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<tr>
<td>• Development of Land use management plan using a community conservation planning approach</td>
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<thead>
<tr>
<th>Drylands management issue</th>
<th>Stakeholders’ responses</th>
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<tbody>
<tr>
<td>• Community involvement in design and testing/implementation of agreed ameliorative practices that the local people agree are feasible</td>
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<tr>
<td>• Strategic development planning and coordination across line ministries and other stakeholders</td>
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<tr>
<td>• Drought contingency planning framework: weak component for ensuring food reserves in the face of drought</td>
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<td>• Institutional capacities development to address some of the conservation measures</td>
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**Lessons learnt in the promotion of good NRM practices in drylands**

<table>
<thead>
<tr>
<th>Drylands management issue</th>
<th>Stakeholders’ responses</th>
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<tr>
<td>• There is need to integrate improved practices with traditional management systems and socio-economic realities in pastoral and agropastoral systems- Improve adoption and dissemination of knowledge that requires approaches far beyond conventional technical research for development, or linear dissemination models</td>
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<tr>
<td>• Using entry points to facilitate change in systems implies creating confidence of local communities and institutions for stronger partnership</td>
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<tr>
<td>• Integrating the whole range of stakeholders in the design and implementation of dryland projects</td>
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<tr>
<td>• There are often different players involved and some similarities across regions, hence it is important to work with other institutions and players to maximize efficiency and avoid overlaps.</td>
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<tr>
<td>Drylands management issue</td>
<td>Stakeholders’ responses</td>
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<tr>
<td></td>
<td>• Often the real constraints are in the social or economic issues and difficult to identify by a single disciplinary team and therefore it is recommended to work with multidisciplinary teams</td>
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<td></td>
<td>• Without the involvement of community leaders and their willingness, very little can be accomplished especially because the land tenure system is communal.</td>
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<td></td>
<td>• The most valuable livestock attributes are often those that successfully guarantee multi-functionality, flexibility and resilience in order to deal with variable environmental conditions - need to encourage communities to off take their animals at the beginning of the dry season when they can fetch good prices (money raised can serve as a contingency for the household during dry season and drought)</td>
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<tr>
<td></td>
<td>• Although overgrazing mainly results from over-stocking, it is difficult to convince pastoral communities to reduce the size of their herds (number of animals). Overstocking is a consequence of several factors, including an increase in the human population (many people with small herds), and a reduction in available grazing lands</td>
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<tr>
<th>Drylands management issue</th>
<th>Stakeholders’ responses</th>
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<tr>
<td></td>
<td>• Due to limited organizational capacity to be able to scale out good practices to cover other areas within the landscape, there is limited impact at very local level. There is need for the organizations to look for resources to expand the program to other areas</td>
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<tr>
<td></td>
<td>• It often appears easier for governments and funding agencies to provide famine relief than to support work that will make these areas more self-reliant.</td>
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<td></td>
<td>• Achieving a peaceful settlement to resource-based conflicts will have direct impacts on the rehabilitation and protection of the environment as the process is associated with development interventions.</td>
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<td></td>
<td>• A participatory approach and an effort to assure the local communities involvement at different levels have contributed to the positive development and given marginalized pastoral groups an effective voice in influencing decisions that affect their lives.</td>
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</table>

Reasons for adoption of good NRM practices in the rangelands (reasons behind adoption)
Creating opportunities for local communities to better understand their management systems and its implication in long term NRM; Identifying few local cadres who are willing to risk and try out the new innovations on behalf of the community, but have an important social role within the community
<table>
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<tr>
<th>Drylands management Issue</th>
<th>Stakeholders’ responses</th>
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<tbody>
<tr>
<td>Using interventions with immediate economic benefits as an entry point and capitalizing more complex NRM issues on the success stories.</td>
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<tr>
<td>Strengthening social institutions, collective action schemes and institutional arrangement that would affect NRM in the area.</td>
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<td>Integrated technological package e.g. market-oriented NRM technology</td>
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<tr>
<td>Incorporation of indigenous knowledge into scientific technology</td>
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<tr>
<td>Good investments in infrastructure, education, training research and development-in these areas</td>
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<tr>
<td>Perceivable benefits and availability of incentives and markets</td>
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<tr>
<td>Integrate environmental sustainability with sustainable development,</td>
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<tr>
<td>Ensure national food security</td>
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<tr>
<td>Cultural beliefs and lack of behavioral change</td>
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<tr>
<td>Lack of property ownership rights</td>
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<tr>
<td>Limited access to economic resources e.g. credit and markets</td>
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<tr>
<td>Unclear national land and land-use policies to regulate inappropriate land use practices that hamper sustainable NRM and development in the drylands</td>
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<tr>
<td>Lack of knowledge and skills and</td>
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<tr>
<td>Lack of incentives and perceivable short term benefits</td>
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**Drylands management Issue**

**Stakeholders’ responses**

- Cultural beliefs and lack of behavioral change
- Lack of property ownership rights
- Limited access to economic resources e.g. credit and markets
- Unclear national land and land-use policies to regulate inappropriate land use practices that hamper sustainable NRM and development in the drylands
- Lack of knowledge and skills and
- Lack of incentives and perceivable short term benefits

**Dryland opportunities for sustainable development**

- Research quantifying the value of ecosystem services and livestock production from the rangelands will help to promote their importance in national agendas
- At the country level these include: Contributing to poverty reduction, improving sustainable rural livelihoods and food security through socio-economic empowerment of pastoralists
- Improving pastoralists capacity for efficient production, processing and marketing of livestock products which could take advantage of new market opportunities
- Integrated natural resource management
- Rehabilitating degraded rangelands e.g. through area enclosure which has also worked in Ethiopian rangelands very well, particularly in areas where collective action and confidence between competing clans was achieved.
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<tr>
<th>Drylands management issue</th>
<th>Stakeholders’ responses</th>
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<tbody>
<tr>
<td></td>
<td>Developing water canals, partly through diverting river basins, has potential to develop drylands, including for development of forage banks and diversification of livelihood options.</td>
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<td></td>
<td>Development and rational distribution of watering points for livestock, which has the possibility of improving productivity and minimizes land degradation on livestock paths and around major watering points / river banks.</td>
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<td></td>
<td>At the regional level, the opportunities include:</td>
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<td></td>
<td>Identifying in collaboration with regional organizations opportunities for regional markets and linking poor pastoralists/agro-pastoralist to markets.</td>
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<td></td>
<td>Cross border co-operation—many of the key issues are best addressed when considered from a regional approach e.g. Livestock marketing, livestock disease control, food security/drought and conflict management, and cross border trade.</td>
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<td></td>
<td>Collaboration in management of shared resources such as grazing and water between countries, which would draw support from regional bodies such as the East African Community (EAC), ECOWAS.</td>
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<td>Low cost of livestock production through strategic exploitation of rangelands and livestock mobility, especially in West African Sahel.</td>
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<th>Drylands management issue</th>
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<td></td>
<td>Low disease burden for livestock in the drylands compared with sub-humid and humid agro-ecological zones; well adapted livestock breeds.</td>
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<td></td>
<td>Growing demand for livestock and livestock products, and good linkage to market in the West African Sahel.</td>
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<td></td>
<td>Presence of highly nutritive annual vegetation species.</td>
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**Specific programmes/projects for promoting sustainable management of the rangeland / fodder development in the region/sub region**

- The Nile BDC (www.nbdc.org) is a research for development programme intending to improve rainwater management systems (including in the drylands of the basin) through developing local capacity and integrating system components at landscape and higher scales. Water as an entry point to intensify systems and increase resilience of systems in the Blue Nile basin of Ethiopia.
- Genebank study, selection and promotion of forage germplasm suitable for specific environment/climate conditions.
- Study on household economics and biodiversity impacts of income from wildlife conservation.
- Research on carbon sequestration potential in East and West African rangelands and the behavioural incentives needed to promote different rangeland management systems.
- Research on the viability of payments for wildlife conservation.
- Research on the value of ecosystem services.
### Drylands management issue

<table>
<thead>
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<th>Stakeholders’ responses</th>
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<tbody>
<tr>
<td>• Research on the importance of maintaining access to water and grazing in pastoral production systems</td>
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<tr>
<td>• Research on the interaction between mobility and market access under increased climate variability</td>
</tr>
<tr>
<td>• Integrated management of rainwater for crop-livestock agro-ecosystems in the Volta Basin</td>
</tr>
<tr>
<td>• An integrated cereal-livestock-tree system for sustainable land use and improved livelihoods of smallholder farmers in the Sahel</td>
</tr>
<tr>
<td>• Some of the programs and key activities at national level include:</td>
</tr>
<tr>
<td>• Establishment of livestock fattening units to add value by increasing live weight before marketing</td>
</tr>
<tr>
<td>• Establishment of cost effective community based animal health and breed improvement services</td>
</tr>
<tr>
<td>• Training of pastoralists on market price information systems that would allow them access to current livestock market prices using market price information boards located within the rangelands</td>
</tr>
<tr>
<td>• Training and facilitation of pastoral communities to move towards a commercially oriented system of production</td>
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### Threats to drylands/rangelands resource management

<table>
<thead>
<tr>
<th>Stakeholders’ responses</th>
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<tbody>
<tr>
<td>• Water scarcity and the potential threats of climate change</td>
</tr>
<tr>
<td>• Population exodus from the countryside and harsh climatic regions (due to lack of opportunities for young generations and youth in the countryside)</td>
</tr>
<tr>
<td>• Repeated lack of good recovery programming after droughts</td>
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<tr>
<td>• Insufficient attention to building resilience to droughts</td>
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<tr>
<td>• Insufficient appreciation of the value of pastoral production and the unsuitability of alternative land uses.</td>
</tr>
<tr>
<td>• Expansion of crop fields to grazing areas due to demographic pressure</td>
</tr>
<tr>
<td>• Inconsistent government policies and lack of investment in development of drylands</td>
</tr>
<tr>
<td>• Weak capacity of local institutions</td>
</tr>
<tr>
<td>• Land degradation, lack of biodiversity conservation and impact of climate change—on natural resources</td>
</tr>
<tr>
<td>• Neglect</td>
</tr>
<tr>
<td>• Overstocking resulting in land degradation</td>
</tr>
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</table>

Rational Use of Rangelands and Fodder Crop Development in Africa

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